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The Philadelphia N. E. L. A. Convention

The convention of the National Electric Light Association which has just closed in Philadelphia will long be remembered as one of the great conventions of the electric-lighting industry. Seldom have sessions been conducted under such a happy combination of conditions, and rarely has such warm-hearted hospitality been extended by a city and its press. One noteworthy feature of the week was the presence of such pioneers as Edison, Brush and Sprague, together with an array of the most prominent men in the electrical industry. Of the papers and reports much might be said. The wisdom of curtailing their number so as to allow greater time for discussion was more than demonstrated. Three accomplishments stand out from other important work of the week and indicate an awakening sense of the association's responsibility. The rescinding of that portion of the overhead-line construction committee's report of 1911 whereby the question of voltage limitation will be eliminated was a most commendable action and removes a bone of contention of three years' standing. The handbook of overhead-line construction and the "Electrical Salesman's Handbook" also represent two distinctive pieces of constructive work performed by the association. Monuments of this sort the association should have erected long ago. That it has done so now augurs well for the national body, which has thus rendered a distinct service not only to its members, but to the industry as well.

President McCall on Regulation

In his address before the National Electric Light Association, President Joseph B. McCall made mention of the most powerful force now affecting the industry, namely, regulation. He referred to the subject in a way that is particularly gratifying, recalling to the audience the definite position on public utility regulation taken by the association in 1907. The leaders of the association at that time had the wisdom and foresight to see that the movement culminating in the New York law of that year would sweep through the country. The association went on record in favor of regulation, adopting the report of its public policy committee. Courage was needed to accept a revolutionary change in the public attitude toward public service enterprises, and courage was forthcoming at the right moment. No one can measure accurately the value of this position to the entire industry in the years from then to the present. With the direction thus pointed the industry generally accepted the principle of regulation, not only as inevitable, but as offering a fair and equitable solution of the problems between company and public. An antagonistic declaration would have been unfortunate, and the absence of any declaration at all would have been a backward step for an industry which prides itself on its sane attitude regarding matters of public policy. The appreciation expressed by Mr. McCall of the action taken in 1907 should arouse an echo throughout the industry in gratitude that the association acted as it did.

Accountants in the N. E. L. A.

A suggestion that the organization of the accountants be enlarged was made by Mr. H. M. Edwards in his address as chairman of the accounting session at the N. E. L. A. convention this week. The accountants should have a more representative organization. Their work is greater and their responsibility larger than before. The public service commissions have given the accountant new duties of much importance. For the relatively simple accounting of earlier days elaborate classifications have been substituted. Care for the detail alone of the new classifications requires executive ability, while the principles concerned demand constant study. The form of organization of the association permits the organization of a regular section for accountants. A recognized section of this kind would place the accountants on a plane, in their association activities, with the steam railroad and electric railway accounting officials. It should increase the attendance at the meetings, the value of the papers and the interest in the discussions. To a greater degree than many executive officials realize the accountant is the one who comes in closest contact with the regulating commission. His work, therefore, should receive all the recognition that the association can give under its scheme of organization.

Value of the Service

The value-of-the-service theory in rate-making is the subject of an extended discussion in the rate research committee report presented at the N. E. L. A. convention this week. This is valuable and timely because of the increasing interest of public service commissions in electrical rate-making. If companies are to build up their business satisfactorily, they cannot disregard value of service as a factor. There is a more logical difference in the value of service for different purposes than in the cost of service for different purposes. Value to the buyer and seller are clearly not the same in many cases, yet an attempt to base relative values on differing costs involves a segregation of ele-

ments upon which accountants are unable to agree. Costs are not the same for different forms of service. If values and costs were the same, the simplest way to make rates would be to make uniform rates. But uniform rates would not develop the gross business needed to assure the largest use of the investment. The central station was formerly idle a large part of the day. Then it developed a market for its product during hours when the customers for whom the plant was originally intended used no energy. By so doing it increased use of capital and efficiency of service and made reduced rates possible for all users. What the companies should do is to make sure that their rates are the same for like purposes. They can justify on plain economic grounds the making of different rates for different classes of service. Rates should be differentiated by class, not by individual. The electrical utility is naturally a monopoly. Yet its rate-making is guided to some extent by actual or theoretical competitive rates. A company would naturally try to make a rate low enough to get business if a competitor was in the market. Though protecting itself and its return on capital, it should also try to make rates equally favorable when it enjoys protection as a monopoly.

The Electrification of New Jersey

In many respects the system of the Public Service Corporation of New Jersey, a description of which appears on page 1329 of this issue, is the most notable agglomeration of interests in the country. Without including any city of the first rank, it serves 178 municipalities, with a population of 2,000,000, and has a yearly output of more than 400,000,000-kw-hr. for motor service, lighting and railways. Its network is in three sections, of which the southernmost is isolated as yet from the others, but all are worked at the standard voltage of 13,200. The system is the growth of a decade, in which time the generating rating has increased threefold and the output in like ratio. During this period there has been a steady concentration of generating equipment so that now the chief station, at Marion, carries 75,000 kw.

In the southern division the chief station is now being built at Burlington, with an ultimate rating of 100,000 kw. Unhappily, the exigencies of railway load forced the company, like many another, into the use of two frequencies so that the distribution is not homogeneous, although in other respects there is a remarkable degree of standardization throughout the system. From the engineering standpoint, the most interesting feature is the thorough system of load dispatching by which the several stations are put into action for maximum efficiency, the main station at Marion being worked at maximum load-factor and the auxiliaries elsewhere being utilized as needed. The complete and thoroughly analyzed record of interruptions which is kept discloses some striking facts. Of the nearly 700 miles of lines about one-sixth is underground, yet the cable failures were chargeable with barely over one-tenth of the service interruptions. Insulator failures, while more numerous, still accounted for only about one-fifth the troubles, showing clearly that main-line troubles are well under control and that miscellaneous accidents to the network are the most prolific sources of service interruptions. In other words, there is practical evidence that the big transmission networks are not in themselves less reliable than the several component plants. In fact, because of better and more systematic inspection they are probably more reliable.

The New Jersey system is now barely beyond the preliminary stages of its growth. It serves a rapidly growing group of communities and is destined to cover fully the great belt of territory along the line from New York to Philadelphia. Its rapid increase of output is the most conclusive evidence of its usefulness to the communities it serves. No similar organization has, we fancy, taken over more numerous and diverse plants giving services to more separate municipalities. It is only a question of very short time before the physical unification of the various properties will be complete, with all the accompanying benefits. It is not wise to look askance at the merger of small plants, for time soon brings its justification.

Developments in Electrical Apparatus

The report of the committee on electrical apparatus read at the National Electric Light Association convention contains much valuable material concerning apparatus of various kinds and sizes, from large turbo-generators to instrument shunts. Special attention is given to out-of-door substation construction, which has recently been rendered necessary by the large size and high voltage of transformer and switching apparatus. In such cases there is no vault so economical to rent and occupy as that of heaven. Climatic extremes of temperatures have, however, to be taken into consideration in the designs of these outdoor substations. Encouraging reports are given concerning the development of large rectifiers in experimental use under service conditions. The prospects are auspicious for the eventual supersession of synchronous converters by rectifiers, which means the substitution of electron-stream motion for rotary mass motion. Electrons have neither brushes nor journal bearings to care for. On the other hand, the use of large synchronous machines for the purposes of voltage control on long lines is steadily increasing.

An important chapter is that devoted to the standardization of mechanical phase rotation in polyphase machinery. The successive advance of phases is indicated very simply and conveniently by the use of the successive numerals 1, 2, 3. Standard rotation from the mechanical point of view is taken as clockwise when viewed from the load end; that is, the pulley or commutator end of the rotating shaft. It is somewhat unfortunate that machine men generally regard positive rotation as clockwise, whereas throughout mathematics positive rotation is taken as counter-clockwise,

perhaps because the earth so rotates as contemplated by an observer standing at the north pole. Whatever the history of the mathematical convention may be, it is somewhat unfortunate that the mechanical convention should be in opposition thereto. However, since every shaft must have two ends, the standard rotation proposed by the committee can be brought into agreement with mathematical convention by stating it in the form that it shall consist of counter-clockwise rotation when viewed from the counter or unloaded end of the shaft—i. e., the end needing a counterweight. By this reversal of viewpoint, harmony between conflicting conventions may be restored.

The report is concluded with some interesting history concerning the co-operation between the committee and the A. I. E. E. in preparing the forthcoming expected new edition of the Institute's standardization rules. The experience and technical relations of the N. E. L. A. committee, as well as of the committee of the Association of Edison Illuminating Companies, have, we understand, been most welcome and helpful to the standards committee in this work; so that it is hoped the new standardization rules, when finally adopted, may be acceptable not only to the Institute but also to all the large electrical engineering organizations in America, while still keeping in substantial conformity with the International Electrotechnical Commission.

Grounded Neutrals in Transmission Systems

The paper by Messrs. Jollyman, Downing and Baum read at the Pittsfield meeting of the A. I. E. E. last week, on the experience of the Pacific Gas & Electric Company with star-connected, three-phase transmission systems and definitely grounded neutral, is strong testimony on behalf of that procedure after more than ten years of experience. The arguments in favor of the grounded high-tension three-phase neutral are essentially similar to those in favor of the grounded low-tension three-wire system neutral—namely, that if a ground comes on an outside conductor, the short-circuit occurs at once and is limited in voltage to that of one branch; whereas with the system normally ungrounded any accidental ground will greatly disturb the potential distribution and tend to produce a ground on the opposite side of the system.

The ground connection as an essential element of the system increases the electrical stability. Of course, any accidental grounding involves a short-circuit when the system neutral is grounded; but that difficulty has to be faced and guarded against in any case. As this question of the neutral free, grounded, or grounded through resistance is debatable ground, the discussion over it was somewhat vivacious. Thus in a paper by Mr. R. C. Clinker read at the same meeting it was pointed out that the star three-phase system may produce peaked voltages higher than the corresponding delta system owing to the unleashing of triple harmonics.

The Public Policy Report

The report of the public policy committee of the N. E. L. A., presented at this week's convention, reaffirms the recommendations of previous years on questions of public concern and welfare work. It is not so constructive as some of the previous reports, but the constructive declarations came in earlier years. Earlier reports were strongly constructive when the problems were mainly new. They outlined fundamental policies which have not lost importance; in fact, these policies have become the vital issues of the day with public utilities. Since the first declaration of these sound policies preceded the declaration of the attitude of other classes of utilities, the electrical industry can fairly reaffirm what others affirm for the first time. It advanced when they at first held back. It led where they now follow. Except very briefly, no other point than that of recognition by the public service commissions of the monopoly character of utilities is mentioned in the section relating to commissions. This indicates that the committee regards the principle of recognition of the monopoly nature of the utility as the most important one emphasized during the year in the relations between commissions and companies. The committee, however, very wisely quotes the California decision which warns the companies that they have no right to accept the benefit of protection in monopoly and to refuse to give the public the good service that they would furnish under competition. In the 1915 report the committee should advise the companies how to conduct operations so as to prevent any criticism that they are abusing their privileges.

Directing attention to the importance of fair rates and good service, the committee declares that rates are the most common point of contact with the public and that usually criticism begins there. Electrical utilities are fortunate because the quality of their service is not always before the public for inspection as is the case with the electric railway. They should tell why they make rates according to the time, use and amount of service. Only by so doing can they protect themselves and build up the largest use of the investment. The committee has properly emphasized the need of the widest publicity for rate schedules and of non-discrimination. It ought not to be necessary to call attention to the wisdom of sound practices in rate-making and service; it is desirable, however, in order that no company may fail to make its practices square with modern public policy.

Although the public policy committee was formed only a few years ago to cope with the many problems discussed, it has been a source of strength and guidance from the beginning. Older though the industry and the association are, they owe much to the stimulating work of this committee. It is necessary only to read the report in order to realize that the committee is contending earnestly with the large problems of the industry and that it should receive the support of all companies in the effort to establish wholesome conditions.

The News of the Week

**Activities and Events in the Electrical Field—
Reports of Meetings—Commission Findings, Etc.**

Cleveland Rate Hearing Case Postponed

In the matter of the appeal of the Cleveland Electric Illuminating Company from an order passed by the city of Cleveland on March 16, 1914, fixing the maximum electric-light rate in the city of Cleveland at 3 cents per kw-hr., the Public Utilities Commission of Ohio on May 25 postponed the hearing, by consent, until further order of the commission, notice to be given to each party. It is probable that the matter will not come up for several months, as the company is preparing to make an appraisal. In the meantime the city is offering electricity at not more than 3 cents or less than 1 cent per kw-hr., making an especial effort, apparently, to get industrial business. The company's rates have been 10, 5 and 3 cents.

Spring Meeting of the A. S. M. E.

The spring meeting of the American Society of Mechanical Engineers will be held at St. Paul and Minneapolis, Minn., from June 16 to 19. Many features of technical and social interest have been arranged. Included in the program will be papers and a topical discussion on powdered fuel, and papers on "Industrial Service Work in Engineering Schools," by Mr. J. W. Roe; "Classification and Heating Value of American Coal," by Prof. William Kent; "The Railroad Track Scale," by Mr. W. W. Boyd; "Gear-Testing Machine," by Mr. Wilfred Lewis, and "A New Flow-Metering Appliance," by Mr. A. M. Levin. Mr. John Hearding, superintendent Oliver Iron Mining Company, Duluth, Minn., will give a lecture on "Iron Ore Handling" illustrated with moving pictures.

Appraisals and Uniform Accounting in Ohio

The appraisal committee of the Ohio Electric Light Association, appointed at the special meeting held in Columbus on May 6, has organized by the election of Mr. Robert Lindsay, of the Cleveland Electric Illuminating Company, as chairman. The other members of the committee are Messrs. F. M. Tait, Dayton; W. W. Freeman, Cincinnati; F. J. Derge, Toledo, and M. F. Millikan, Canton. The committee was appointed to represent the electric-service companies of the State in carrying out the instructions of the Public Utilities Commission of Ohio in the matter of the appraisal and valuation of the utilities of the State for rate-making purposes. The committee has started on its important task, taking up first the preparation of forms.

On the part of the committee on uniform accounting, also appointed by the association on May 6, Mr. Scobell was instructed to arrange a meeting with Mr. Carl Nau, of Cleveland, certified public accountant. Mr. Nau has been retained by the Public Utilities Commission of Ohio to advise it in relation to the preparation of a system of uniform accounts for the utilities of Ohio. The committee of the Ohio Electric Light Association on uniform accounting consists of Messrs. J. H. Scobell, Cleveland Electric Illuminating Company; L. K. Funkhouser, Dayton Power & Light Company; T. F. Wickham, Cincinnati; F. B. Lasher, Youngstown, and F. W. Drager, Canton.

Twenty-fifth Anniversary of First E. E. Course

The twenty-fifth anniversary of the inauguration of electrical-engineering studies at Columbia University—declared to be the first purely electrical-engineering course established in America—was celebrated with informal ceremonies at the university, New York City, May 30. A number of alumni attended the meeting, and brief reminiscent addresses were made by Profs. Francis B. Crocker and Michael I. Pupin, who have served as members of the faculty since the creation of the department. Hon. Thomas Ewing, United States Commissioner of Patents, was also present and spoke of the pioneer days of the electrical industry, and Prof. W. I. Slichter outlined the plans for future graduate instruction in electrical engineering, which, beginning with this fall, will wholly supersede the present undergraduate courses.

Columbia was the first and for several years the only institution to put electrical engineering squarely on an equal, independent basis with mining, civil and mechanical engineering, said Professor Crocker. The Columbia electrical course was established in May, 1889, whereas in all other institutions of that time the electrical courses were subdivisions or off-shoots of the older courses in physics, chemistry and mechanical engineering. A copy of the prospectus of the Columbia course as originally written in 1889 was also exhibited by Professor Crocker. It covers in surprisingly thorough fashion even the wide range of the science and art to-day, with the single exception of wireless telegraphy, although this may be fairly considered to come under the heading of telegraphy, which was an important division of the early course.

"Selling Electric Vehicles" in Moving Pictures

At the Willow Grove Park Theater, Philadelphia, Tuesday evening, the Electric Vehicle Association of America made the first public presentation of its new moving-picture film entitled "Selling Electric Vehicles," the parts in which were taken by a number of amateur actors prominent in the work of the vehicle association. Among those appearing in the picture are Messrs. F. W. Smith, Harvey Robinson, S. G. Thompson, W. P. Kennedy, J. Becker, A. J. Marshall, P. D. Wagoner, Charles Blizard, Bruce Ford, W. G. Bee, W. C. Andrews, and others. The film was produced by the Edison moving-picture company and has been presented to the Electric Vehicle Association by the Edison Storage Battery Company. It will be loaned for exhibit before various electrical gatherings throughout the country to stimulate interest in the electric vehicle.

The story of this picture-play was written by Mr. S

G. Thompson, of the Public Service Electric Company, Newark, N. J., and its opening scene shows the transportation troubles of a big city merchant who receives discouraging reports from his stable foreman on the ravages of death and disease among his horses. Transportation costs are eating up the returns of the business and bankruptcy seems imminent, when the interest of the merchant is attracted by a letter from the Electric Vehicle Association pointing out the advantages and economies of electric vehicles. Reaching the association headquarters by wire, the executive is soon in possession of additional figures and data which further excite his interest in electric transportation. The local central-station man is summoned, and the services of a consulting engineer are also enlisted for a study of the problem. Meanwhile the battery salesmen learn of the situation, and call at the merchant's office. Demonstrations of the discharge capacity, power, construction, etc., of both the lead and nickel-iron storage batteries follow. The last caller is a salesman of commercial electric cars, who convinces his customer in quick order by arranging a parade of electric trucks just outside the office window, and a contract is soon signed for a fleet of ten electric power wagons. The sequel is shown in the final picture, staged a year later.

SCENE FROM ELECTRIC-VEHICLE MOVING-PICTURE FILM

The electric trucks are giving splendid service, having effected a saving of $10,000 during the twelve months, the concern is prospering, and the merchant is enjoying the conveniences and dependability of his all-electric transportation service.

Attitude of California Commission on Hydroelectric Development

The following statement has been made by Mr. John Hays Hammond in regard to public utility and water-power development under the California commission:

"I am interested in hydroelectric developments in California, and must admit that when the Railroad Commission was established to control the developments of this industry I shared the apprehension of others interested in water-power companies that there would be some serious disadvantages in the operation of those companies by reason of restrictions imposed by the Railroad Commission. But, as a result of my own experience, I am confident that, on the whole, such a commission is of great advantage not only to the investors in the securities of such companies and the consumers of power, but to the companies themselves.

"I discussed with the Railroad Commission many phases of the development of hydroelectric companies. The commission is sincerely desirous of encouraging the development of such enterprises in the interest of the people of the State in general, and the commission absolutely repudiates the rumors that have been current that it would oppose any capitalizations of companies and any rates for energy that would make it possible for investors to earn more than 6 per cent on the investment.

"It realizes that such investments must be attractive to investors, and it is willing to allow a rate of earnings attractive to the legitimate investor. Besides this, the commission has wisely established the principle that it will not encourage cut-throat competition in the industry."

Annual Meeting of Society for Electrical Development

At the meeting of the Society for Electrical Development, Inc., in the Bellevue-Stratford in Philadelphia on June 1 Mr. J. M. Wakeman, general manager of the society, reported that the $200,000 required to start business has been pledged and that the best men available for promoting the electrical development work have been secured. The work of the society has been divided for the present into four sections: Field co-operation, new development, commercial exchange bureau, and publicity and advertising.

A man to supervise the work of the first section has not been secured yet, but Mr. Robert N. Lee has been engaged to assist the person selected. Mr. John P. Mallett has been employed to investigate the present uses of electricity and report how these applications can be extended. The commercial exchange bureau, which is in charge of Mr. Theodore Dwight, will secure and index information regarding the uses of electricity. The bureau will prepare bulletins containing this information, which will also be furnished to class journals for publication. The publicity and advertising department is in charge of Mr. H. C. Spaulding.

Whoever may be appointed to supervise the field co-operative section will travel around the country forming co-operative leagues, inducing architects and builders to arrange for complete electric service instead of lighting alone, and bringing textbooks and lecture courses up to date.

Realizing that moving pictures are among the best mediums for educating the public, the society has established a department in charge of Mr. L. G. Harkness-Smith, who is arranging for photographing scenarios illustrating the uses of electricity in the home, mill, factory and farm.

A window-trimming department has also been organized and placed under the supervision of Mr. A. J. Edgell. Sample electrical displays are being set up in windows and photographs taken and distributed among the members of the society. Printed instructions on how to trim the windows are sent with the illustrations.

Mr. Wakeman reported that the present society membership consists of 298 central stations, 186 manufacturers, 272 jobbers and dealers, 588 contractors and 23 miscellaneous industries. While the amount ($200,000) required to start operations has been secured the society is still desirous of increasing its membership in order that the development work may be made more extensive.

Following Mr. Wakeman's report the acting treasurer, Mr. James Smieton, Jr., read his report.

By vote of its members the society changed the fiscal year to end April 30, instead of May 15, to facilitate preparing the annual report before the convention meet-

ing. New members of the board of directors were elected to represent the central stations, manufacturers, jobbers and dealers and contractors, as follows: Messrs. J. E. Montague, Niagara Falls, N. Y.; H. B. Crouse, Syracuse, N. Y.; Fred. Bissell, Toledo, Ohio, and G. M. Sanborn, Indianapolis, Ind., each to serve four years.

At the meeting of the board of directors which followed a number of important matters were discussed, including a resolution defining the policy of the society in regard to central stations merchandising apparatus, supplying incandescent lamps to customers, etc. The resolution, which was unanimously adopted, stated: "That the society's efforts shall be devoted to developing the use of electrical energy by the general public, thus increasing the market of all engaged in the industry, leaving the question of defining the channels through which, and methods by which, the present and increased market shall be reached to experience and local co-operation."

The following officers were elected to serve for the ensuing year: President, Mr. Henry L. Doherty, of New York; first vice-president, Mr. W. H. Johnson, of Philadelphia; second vice-president, Mr. A. W. Burchard, of New York; third vice-president, Mr. W. E. Robertson, of Buffalo; fourth vice-president, Mr. J. R. Crouse, of Cleveland; fifth vice-president, Mr. Ernest Freeman, of Chicago; general manager, Mr. J. M. Wakeman; acting secretary-treasurer, Mr. James Smieton, Jr. The following were elected to serve as the executive committee during the ensuing year: Messrs. H. L. Doherty, Ernest Freeman, A. W. Burchard, J. R. Strong, Gerard Swope, L. A. Osborne, W. E. Robertson, J. R. Crouse and W. H. Johnson. Mr. Johnson was elected chairman of the executive committee. The board approved the action of the executive committee of March 30, 1914, adopting the plans and budget for the first year's activities of the society.

A resolution was adopted to the effect that any member whose semi-annual subscription becomes seven months in arrears shall be dropped from membership in the society.

Universal Use of Electricity on the Panama Canal

With the electrification of the Panama Railroad, which is being seriously considered, electrical operation on the Isthmus will be practically complete, said Mr. D. P. Gaillard, Chicago, before a recent meeting of the Electrical Section of the Western Society of Engineers and the Chicago Section of the American Institute of Electrical Engineers. That our government realizes how important are the electrical features of the canal is evidenced by the recent appointment in the permanent canal control organization of an electrical engineer who is subordinate only to the governor of the Canal and the engineer of maintenance.

Continuing his description of the electrical work which is being carried out on the Isthmus, the speaker described the 6000-kw hydroelectric plant at Gatun, operating on a 77-ft. head and at its maximum demand requiring but 7 per cent of the minimum water available. The only unusual feature in the design of this plant is the location of an emergency exciter on the main shaft of the turbo-generators between the turbine and the generator. Ordinarily motor-driven exciters are used. Supplementing this power house is a steam reserve station with four units aggregating 6000 kw at Miraflores, and the steam-electric construction plant at Gatun. The high-tension line distributing 44,000-volt energy to four substations near the greatest centers of load—at Gatun (Atlantic locks), Miraflores (Pacific locks), Cristobal and Balboa—was described. The load at the two last-named places is largely made up of machinery operating on the wharves, shops, dry docks, etc. Fearing that induction would disturb communication, all telegraph and telephone circuits were placed underground.

Although the hydroelectric station, upon which dependence is placed, is rated at but 6000 kw, the connected load is approximately 20,000 hp, motors ranging in size from 75 hp to fractions of a horse-power. Two hundred and fifty miles of lead-covered cable were used in making these installations.

Speaking of the unforeseen things which have happened since the completion of the canal, Mr. Gaillard cited the fact that, upon the emptying or filling of the locks at Pedro Miguel, surges were set up approximating 1 ft. or more in amplitude and lasting for as long as an hour. These surges sometimes make it momentarily impossible to open the gates.

Dynamite charges in the canal work were always fired electrically. At first series circuits were used for this purpose. Later, however, it was discovered that by the use of 110-volt multiple circuits no cartridge missed fire, as sometimes happened with the series arrangement.

The discussion was confined almost entirely to questions from members seeking further information. Those participating were Messrs. F. J. Postel, F. A. Banning, Jr., L. L. Holladay, G. A. Mayer, L. P. Howard, E. T. Foote, W. S. Pederson, William B. Jackson, B. H. Peck and H. M. Wheeler.

An invitation to the Chicago Section of the A. I. E. E. from the Spokane Section of the A. I. E. E. was read, asking the members to attend the Pacific Coast convention to be held in the Davenport Hotel, Spokane, on Sept. 9, 10 and 11.

Competition in Portland, Ore.

In the annual report issued to stockholders of the Portland (Ore.) Railway, Light & Power Company, covering the operations during 1913, Mr. C. M. Clark, chairman of the executive committee, and Mr. Franklin T. Griffith, the president, discuss the entrance of a competitive company.

Mr. Clark says that the entrance of the Northwestern Electric Company into the lighting and motor-service field in Portland is to be regretted, but that, in view of conditions in other Pacific Coast cities, competition of some kind was probably inevitable. The total development of the new company is small compared to that of the Portland company, and the competition is restricted to the lighting and motor service business in Portland and does not affect the railway business nor the lighting and motor-service business in the other communities served by that company. It is as unfortunate for the Northwestern company as for the Portland company, Mr. Clark adds, that it should have made its investment and entered the field at a time when there was not sufficient new business available to warrant the investment.

Mr. Griffith explains that on Dec. 23 the Northwestern Electric Company began serving customers on the east side of the city, and by March 9, 1914, had extended its operations to the west side. This company, which will compete for business in Portland, has completed a hydroelectric plant of 12,000 kw on the White Salmon River, about 70 miles from that city. Probably 5000 kw of this generating capacity will be required by the Camas Paper Mills, and the remainder, when available, will be brought into Portland. At times of low water the deficit will be made up by a steam plant of 7500 kw rating in the business district of Portland, which is also equipped to supply steam heat.

National Electric Light Association Convention

Attendance at Philadelphia meeting exceeds 4000—News features of general interest outlined below—Formal papers and discussions abstracted on pages 1305-1328 of this issue

THE convention of the National Electric Light Association held in the Bellevue-Stratford Hotel, Philadelphia, this week, will long be remembered as one of the most successful gatherings of electric-light men in the country. Not only was the attendance large—more than 4000—but there was a notable gathering of the prominent men of the industry. In addition, pioneers like Edison, Brush and Sprague graced the public policy meeting on Wednesday night, when each received an ovation.

The convention arrangements were ideal. Seldom in the history of the organization have sessions been so well attended and been marked with more enthusiasm. Comments of the most favorable kind were heard on all sides regarding the exhibition of the Class D members on the roof of the hotel, and although the exhibition as a whole might be characterized as a group of reception booths rather than working exhibits, the Class D members were generally gratified with results and the delegates expressed nothing but admiration for the layout. The daily press of the city was exceptionally responsive in its treatment of the convention and in editorial comments, and the people of the city, as well as all those in attendance, evinced a warm interest in all that transpired. The plan of cutting down the number of papers so as to give greater time for discussion proved to be most wise.

In accomplishment the convention was most successful. Not only were two important books of vast usefulness to the industry brought out—namely, "The Electrical Salesman's Handbook" of the Commercial Section and the "Handbook on Overhead Line Construction"—but the association rescinded its action on the 1911 report of the committee on overhead-line construction by eliminating from it any recommendations, by inference or otherwise, of voltage limitations. At the session of the Hydroelectric Section on Thursday morning it was decided on the recommendation of the executive committee of the association to discontinue the Hydroelectric Section and to place work heretofore done by that section in the hands of a proper committee.

In accordance with previous action taken at Seattle, the next convention of the association will be held in San Francisco.

Elsewhere in this issue are printed abstracts of papers, reports and discussions, while the other activities of the convention are recorded in what follows.

Opening Events

The convention opened with a reception held by President and Mrs. McCall in the ballroom of the Bellevue-Stratford Hotel on Monday night. Friendly greetings were extended to the hundreds of delegates and guests in attendance, to the accompaniment of music rendered by the Philadelphia Company Section's orchestra of twenty-five pieces. The ballroom was most tastefully decorated for the occasion, and following the reception informal dancing was enjoyed and the warm hospitality there extended by Philadelphians continued throughout the week.

The regular work of the convention began on Tuesday morning, with President McCall in the chair and the great ballroom of the hotel filled. Mr. McCall introduced the Hon. Rudolph Blankenburg, Mayor of Philadelphia, who welcomed the convention to the city in a really inspirational address. The Mayor, in passing, testified his high appreciation of the benefit to civilization, the betterment of home conditions, manufacturing facilities and scientific development born of the great electrical industry. The dominant note of his address, however, aside from his plea to the delegates to witness what Philadelphia is doing to safeguard the lives of little children and instructing mothers in their care, had reference to municipal ownership and to the elimination of politics from the administration of municipal affairs. On this subject Mayor Blankenburg waxed most eloquent. He said that in England, and especially in Germany, city administrations are far ahead of those in America, and that Americans know too well that in many cities the administration of municipal affairs is inefficient. He asked what would happen to the great National Electric Light Association if it were so beset in its work by politicians as most cities are in carrying out their destinies. The address was well received and a rising vote of thanks was extended to the Mayor.

FIG. 1—WELCOME ARCH ERECTED BY THE PHILADELPHIA ELECTRIC COMPANY

Mr. H. H. Scott, vice-president, then took the chair while President McCall delivered his address.

Presidential Address

In his annual address as president of the National Electric Light Association Mr. McCall noted that the last convention held in Philadelphia convened in the assembly room of the Union League twenty-seven years ago. He spoke also of the fact that this year marks the thirtieth anniversary of the first international electric congress and the first international electrical exposition, both of which were held in Philadelphia in

1884. He commented on the great growth of the association and referred to the effort made to limit the number of papers with the view of giving more time to discussion.

During the year the public policy committee held a number of meetings and has continued its valuable work in dealing with broad questions of public policy. Joint meetings have been held with other organizations looking toward co-operative effort. Upon the important question of government control Mr. McCall said the principle of governmental regulation through the medium of state commissions has been generally adopted and in the many activities of those bodies has lead to a better understanding of the relations between the public and the utilities. Commissions have evinced a general disposition to use wisely the powers intrusted to them and in their administration to safeguard the equities of all parties concerned.

Special mention was made of the work done by the rate research committee during the year and attention was called to the work of the educational committee and to the great movement in accident prevention and welfare work. The president said he had been impressed with the need of some change in the financial plan of the organization because the income derived was not sufficient and important work was therefore left undone. He said a plan should be devised which will warrant the most liberal treatment of Class B members, while at the same time permitting them to possess an independent interest by contributing to the work of the association through the medium of the membership fee. In his estimation there should be a re-rating of the dues in Classes A and D. The president also made mention of the foreign members, which at the close of the convention totaled 33.

As is customary the president's address was referred to a committee, consisting of Messrs. C. L. Edgar, Boston; J. L. Gilchrist, Chicago, and F. M. Tait, Dayton, Ohio, which reported its findings at Friday's session.

Organization of the Industry

Mr. H. H. Scott, in his report on the organization of the industry, gave the membership of the association as follows:

Class	June 2, 1914	June 3, 1913
A	1,091	1,093
B	10,817	10,256
C	73	53
D	250	242
E	785	798
	13,016	12,442

He pointed out, however, that there was an error in last year's report, which showed 44 too many class A members and 330 too many Class B members, so that in reality instead of a loss there was an actual gain of 42 Class A members. Such losses as occurred in operating companies were due to consolidations and to the acquisition of holding companies. Of the 6129 towns and cities, with a population of 46,000,000, receiving service, 2691, with a population of 36,400,000, are served by 140 holding companies. The Class B membership in company sections showed a loss of several hundred and the number of geographic sections has not increased.

Report of Secretary

Secretary Martin in his report told of the miscellaneous work handled in the executive offices in New York City. Of last year's proceedings 19,000 volumes were printed. The monthly bulletin has been increased in size. No fewer than 150,000 copies were printed and distributed during the year, and the *Bulletin* itself is now admitted as second-class matter by the post office authorities, resulting in a saving of $2,000 in postage. Of the general publications of the association, 40,000 have been sold in addition to over 180,000 of special pamphlets and brochures of the Commercial Section. The "Meterman's Handbook" has reached a sale of 4150 copies, and the association has just issued the new handbook on overhead-line construction, 900 pages, and the new salesman's handbook in loose-leaf form, with special binder and case. The lecture bureau has proved its usefulness. There are approximately a thousand lantern slides and three motion picture films used in connection with the lectures, which were delivered eighty-one times during the year to approximately 16,000 employees. The rate-research bulletin has reached its fifth volume and has 583 subscribers. Other points touched on by Mr. Martin in his report were the results of his European

FIG. 2—ONE OF THE AISLES IN THE ROOF-GARDEN EXHIBIT HALL, NATIONAL ELECTRIC LIGHT ASSOCIATION CONVENTION, PHILADELPHIA

trip, educational conferences, accident prevention, electric vehicle co-operation and public service commission annual report forms.

Report of the Insurance Expert

In his report as insurance expert, Mr. W. H. Blood, Jr., of Boston, told of his relations with the National Fire Protective Association, and of the wide adoption by municipalities of the National Electrical Code. Two matters of importance which will come up for consideration at the meeting of the Fire Underwriters in New York City next March are revisions of the rules on constant potential pole lines of over 5000 volts and on the use of renewable and refillable fuses. Attention was also called to the work of some inspection bureaus in the examination of electric lighting properties with a view to reducing liability of fires arising and amount of insurance premiums.

Mr. Leonard Fitzgerald, of the Gary (Ind.) Heat, Light & Water Company, said that in that city the municipal authorities have appointed the underwriters' inspectors the electrical inspectors of the city.

Committee on Progress

The report on progress, prepared by Mr. T. C. Martin, dealt as usual with the general conditions of the industry and presented its statistics as based on the United States census figures of 1912, with other data on development. Sections were devoted to public questions, such as the relations and usefulness of holding companies, public service commissions and regulation, and municipal ownership. Various features of engineering work were discussed, one or two typical new plants being described rather fully. Advance in different fields, such as lamps and lighting, electric vehicles, electric heating and cooking, railway energy, industrial uses of electricity, electric pumping and ice making, signs and slogans, and electricity on the farm, were reported. Some miscellaneous applications of central-station energy were also recorded, and recent educational and welfare work chronicled.

Question Box

Mr. S. A. Sewall, assistant secretary of the association, in speaking of the work of the Question Box, said it was designed to be a clearing house of experiences. During the year it contained 254 new questions, with 1296 answers, made by 746 contributors. The method of handling inquiries was outlined in detail.

Safety First

One of Paul Lüpke's classics, which have been features of conventions for many years past, was again forthcoming this year, but this time it was read by the Sage of Trenton himself. The author called attention to the necessity of reiteration for the purpose of driving a matter home to those whom it is wished to reach. He appealed to the rank and file for the development of the convention spirit and pointed out various causes for the lack of this spirit. The paper was in Mr. Lüpke's characteristic epigrammatic style, and the following are some of the trite sayings: "Business is no poker game." "The man who can keep his head level in an emergency and instantly recognize a true 'Carnegie medal occasion' that demands taking a risk is a real hero." "Nowhere else does dire tragedy tread so closely and so frequently upon the very heels of supposedly harmless fun than in the working out of a practical joke." "In the name of common sense, live within your means: it's the best means of getting more to live on." "For all kinds of sports we train. We take particular precautions to guard our health. Why then ignore the axiom that life itself is the most exacting sport of all?"

Tuesday Afternoon's Session

The first technical session held on Tuesday afternoon was presided over by Mr. W. F. Wells, of Brooklyn, N. Y. The feature of the session was the address of Dr. C. P. Steinmetz on the electric vehicle, which is printed elsewhere in this issue.

Address of Chairman Jones of Commercial Section

Mr. T. I. Jones, of Brooklyn, N. Y., in opening the first commercial session on Tuesday afternoon spoke of the things accomplished during the year and made some pertinent suggestions and recommendations. He traced the growth of the Commercial Section during its four years of existence, from a membership of 163 to a membership of 1793 and from an inconspicuous modest start to a useful force among the commercial men in the industry. One of the most interesting developments in the past year has been the matter of the section's publications. The "Electrical Salesman's Handbook" added this year, Mr. Jones maintained, is a monument to the industry of the publication committee and a credit to the section. The other publications followed along the same general lines as last year, excepting that the section is now about to introduce a new advertising campaign called "Residence Business." Co-operative relations have been held with the Electric Vehicle Association, the National Electrical Contractors' Association, the Electrical Supply Jobbers' Association and other national bodies, which have been of mutual benefit. Mr. Jones referred to the fact that the number of reports arranged for each session had been limited to two and that only six committee reports had been compiled throughout the year.

Mr. E. L. Callahan, of Chicago, in his report for the finance committee, showed that the Commercial Section had a substantial amount in its treasury.

Commercial Section Membership

Mr. J. F. Becker, of New York, chairman of the committee on membership of the Commercial Section, reported a net gain of 239 members up to May 15, 1914, at which time the total membership of the Commercial Section was 1461. The plan of increasing membership through active state captains did not show the results expected. This was attributed to the additional dues demanded by the Commercial Section. The committee felt that as soon as this question of dues is eventually settled the ranks of the Commercial Section will be greatly increased. A printed list of the membership as of Jan. 1 has been mailed to each member of the section.

Address of Chairman Edwards at Accounting Session

Mr. H. M. Edwards said that the time has come for the accounting committee to determine whether some change should be made in its organization so that the scope of the work will be more representative of the industries embraced. He suggested that delegates select their own officials. The most important work of the accounting committee was the completion and adoption of a classification of accounts. The chairman pointed out that the standing of a corporation in the estimation of a state commission and the public is largely dependent on the character of its records and the accuracy with which they are kept.

To fill his position most effectively an accountant should be a close student of economic literature. When the company he represents is attacked on subjects relating to rates, etc., the accountant must furnish the defense from the records he has in charge. Data should therefore be intelligently selected and concisely arranged. The chairman also suggested that special assessments on members of the accounting committee should be discontinued and only the regular N. E. L. A. membership fees be required.

Mr. C. L. Campbell, New York, made a motion which was passed to the effect that the accounting committee be organized along national lines and that special dues from its members be abolished.

Wednesday Morning Sessions

At the second technical session held on Wednesday morning a great deal of interest was evinced in the report of the committee on overhead-line construction, of which Mr. Thomas Sproule, of Philadelphia, was chairman. The report of this committee was printed in full in an 800-page handbook on overhead-line construction prepared by the sub-committee, and warm appreciation of the work of the handbook sub-committee was expressed on all sides.

Two very important matters were also brought out before the commercial session, one the report of the rate research committee and the other the report of the lamp committee, which was followed by an exhibit of lighting units.

The feature of the second accounting session of Wednesday morning was the address of Dr. D. C. Jackson, of Boston, on "Appraisals." The uniform system of accounts was also brought up for official discussion at that session.

Treasurer's Report

At the executive session on Wednesday afternoon Mr. W. F. Wells, of Brooklyn, in his report as treasurer showed that the revenue received from all sources during 1913 was $122,519.61, against which were charged running expenses of $84,156.94 and convention expenses of $34,241.97, or a total of $118,398.91, leaving a surplus of $4,120.70.

The treasurer's report was referred to an auditing committee consisting of Messrs. J. F. Gilchrist, of Chicago, and T. C. Martin, of New York.

Constitutional Amendments

Mr. Frank W. Frueauff, for the committee on constitutional amendments, also submitted the following proposed amendments at the executive session on Wednesday, and these were adopted at the session on Friday morning.

To amend Article IV, Section 2, first sentence, to read:

"The president, vice-presidents and treasurer shall be elected from Class A or Class B members, to serve one year from July 1 or until their successors shall have been elected."

To amend Article IV, Section 3, first sentence, to read:

"The executive committee shall consist of the president and vice-presidents, of the treasurer and the retiring president and of nine members elected from Class A or Class B."

To amend Article IV, Section 6, first sentence, to read:

"The treasurer shall perform the duties assigned to him by the executive committee and subject to its approval."

The purpose in all the above amendments was to make the treasurer of the association an elective officer and to give him a vote at the meetings of the executive committee.

To amend Article VII, Section 1, first paragraph, to read:

"The annual dues of member companies (Class A) in cities and towns of less than 5000 population shall be $10; in cities and towns of 5000 and less than 10,000 shall be $15; in cities and towns of 10,000 and less than 25,000 shall be $20; in cities and towns of 25,000 or more shall be $25 plus one-fiftieth of 1 per cent of the gross earnings from the sale of electrical energy by the company for the preceding calendar year."

To amend Article VII, Section 2, to read:

"The annual dues of Class B members shall be $5, including membership in a geographic section and in a national special section. Class B members shall receive without cost such publications as shall be approved and authorized by the executive committee for distribution through a national special section."

To amend Article VII, Section 4, to read:

"The annual dues of Class D members shall be fixed by the executive committee, but in no event shall the dues of any such member exceed $2,500 per annum."

To amend Article VII, Section 5, to read:

"The annual dues of Class E members shall be $5, including membership in a geographic section and in a national special section. Class E members shall receive without cost such publications as shall be approved and authorized by the executive committee for distribution through a national special section."

The above amendments were recommended to enable any Class B or Class E member to belong to the particular special section which he may care to select without the payment of any extra dues and to give him the full benefit of such section's work.

To compensate for this loss of revenue from individual members, to add to the association's annual revenues for the carrying on of further important work of the industry, and to enable the Class A and Class D members to contribute a larger proportion of the association revenues, the committee recommended that the percentage dues paid by the companies in cities of over 25,000 be increased and that the manufacturing and supply companies pay annual dues upon a basis to be determined from time to time by the executive committee within reasonable limits.

At the close of the executive session the following nominating committee was elected: Messrs. Frank W. Frueauff, of New York; John F. Gilchrist, Chicago; W. H. Johnson, Philadelphia; F. M. Tait, Dayton, Ohio, and J. L. Bailey, Baltimore.

Public Policy Meeting

The public policy meeting on Wednesday night was a gala affair. Preceding the meeting a dinner was given in the "red room" of the hotel to members of the committee and distinguished guests by Mr. Arthur Williams, its chairman, and President J. B. McCall. Fifty covers were laid, the table presenting a very beautiful appearance with an electric fountain as the center of a very ornate decorative scheme. The "place cards" consisted of convention numbers of the Philadelphia Electric Company section magazine, *Current News*, in individual gilt-lettered leather bindings. At the close of the dinner there were informal addresses, and a pleasurable feature was the presentation by Mr. Williams, as presiding officer of the last New York Electrical Show, to Mr. Thomas A. Edison, the guest of honor, of a solid gold medal bearing the portrait of the great inventor. Those in attendance included Messrs. T. A. Edison, Charles F. Brush, Frank Sprague, S. T. Bodine, E. W. Rice, Jr., Guy E. Tripp, Frederic Nichols, T. N. McCarter and all the past-presidents of the association and members of the public policy committee in attendance.

Comments of Mr. Insull

After concluding the reading of the report, Mr. Insull called attention to the growing importance of the electrical industry in civic life. Its prosperity, he said, depends very much on the prosperity of the country, and yet, strange to say, hard times do not seem to affect it. This he attributed to the fact that not any of the companies have yet developed their territories

to the saturation point. In older cities, where the companies have succeeded in getting a larger proportion of available business, general business conditions do in a measure show some effect on the income. He voiced the seriousness of any contemplated national legislation designed to limit the activities of generating companies to certain states or communities. Legislation of this type has kept back economic development and utilization of electricity in England, and if enacted in this country will seriously check the use of electricity, especially in the rural districts, which now enjoy electrical advantages only because of the activities of large holding companies in covering the country with networks over which electricity is transmitted from one state to another. Mr. Insull suggested that some missionary work be done in educating congressmen and senators on the economics of the business as a natural but regulated monopoly, so that there would be no tendency to check electrical interstate business through misdirected anti-trust legislation.

Exposition Anniversary Exercises

Notable exercises marking the thirtieth anniversary of the First International Conference and the First International Electrical Exhibition, held at Philadelphia in 1884, followed the presentation of Mr. Insull's report on Wednesday night.

Seated on the platform and in the audience and honoring the occasion with its presence was a brilliant company, which included a number of the master workers and commercial leaders of the electrical industry. Among those who occupied places on the stage were Mr. Edison, Charles F. Brush, Frank J. Sprague, E. W. Rice, Jr., President J. B. McCall, Samuel Insull, Arthur Williams, C. L. Edgar, J. W. Lieb, Walton Clark and H. H. Scott.

President McCall introduced Mr. Walton Clark, president of the Franklin Institute of Philadelphia, under the auspices of which the International Electrical Exhibit of 1884 was held. This exhibit was the first expression of the kind ever devoted exclusively to electrical devices. In his introductory remarks President Clark cited the influence wrought by the spirit of Franklin and by the Franklin Institute on the electrical industry of to-day and its scientific and industrial development.

Address by Mr. E. W. Rice, Jr.

Mr. E. W. Rice, Jr., president of the General Electric Company, who was the next speaker, compared for the benefit of his audience electrical conditions existing in the year of the Philadelphia exhibition with the development achieved to-day. In 1884, he said, not a single trolley car was in existence, the highest potential employed was 2000 volts, the largest currents in use did not exceed the order of 5000 amp, the largest electrical generator was the Edison "Jumbo" machine with a rating of 1200 16-cp lamps, and the largest engine on exhibition was of less than 150 hp. The electric motor was just coming into use, although less than 500 hp had yet been applied. A feature of the Franklin Institute exhibit was, however, an electrically operated printing press on which the *Electrical World* was printed during the period of the exposition.

The international electrical conference was distinguished by the presence of such scientists as Kelvin, Preece, Thomson, Newcomb and Rowland. This Philadelphia conference ratified the present system of electrical units, although incidentally much dissatisfaction was expressed with the accuracy of the available measuring instruments. No other influence has contributed so much to the rapid development of the electrical industry, said Mr. Rice, as has the convenience with which electrical energy can be measured.

Dr. Brush's Reminiscences

In introducing Dr. Charles F. Brush, inventor of the arc-lighting system, President Clark declared that no man in history has done more than did Dr. Brush for the protection of life and property in the great cities by his provision of a scheme of general street lighting. After detailing some interesting reminiscences of early experiences with his electric lighting system, Dr. Brush told of the pioneer electric lighting of John Wanamaker's Philadelphia store by twenty arc lamps in 1878, and the first electric street illumination in Cleveland's public square the year following. Dr. Brush said he traced the great development of electric lighting as having followed upon the invention of the series arc system in 1878, which made it possible for one generator to operate a large number of lamps. The electrical industry, said the speaker in conclusion, is now absorbing capital at the rate of $1,500,000 every working day.

F. J. Sprague on Railways, Past and Future

Mr. Frank J. Sprague, the last speaker, declared that the N. E. L. A. should add the word "power" to its name, since the connected load in motors served by the lines of its member companies now even exceeds their total load in lighting units. Invention, said the speaker, is seldom due to inspiration, but is rather the result of necessity. Mr. Sprague compared the Edison generator exhibited at the early exposition with the great turbine unit, 10,000 times as large, now being installed by the Philadelphia Electric Company. He also referred briefly to his own work in the installation of an electric street-car line in Richmond, Va., in 1887, and he exhibited a piece of the first cloth woven on a constant-speed motor-driven loom.

After a comment on the apathy displayed in substituting electricity for steam on the New York elevated railways in the early nineties, Mr. Sprague declared that for trunk-line electrification the electric locomotive still has in its steam competitor a worthy rival, particularly when electrification involves the scrapping of expensive equipment and the purchase of other expensive apparatus. He predicted with certainty the coming of centralized energy generation, with interconnecting transmission lines following railroad rights-of-way, perhaps in underground conduits for greater safety and reliability. Such great central stations, he insisted, can produce electricity more cheaply and more dependably than could the railroads themselves. But even before the electrification of the railroads, prophesied Mr. Sprague, there will come some means of positively connecting the signals along the right-of-way with the control levers in the locomotive cab, so that in the event of failure of the driver to observe signals the train will be automatically braked and collisions avoided.

The Age of Co-operation

In a witty address that held the lively interest of his audience for more than an hour, and was punctuated by numerous epigrams which earned the enthusiastic applause of his hearers, Mr. Elbert Hubbard, East Aurora, N. Y., spoke before the Commercial Section Thursday morning on the subject of the coming of the age of co-operation.

"In the future," said the speaker, "we shall talk less and say more, write less and mean more, eat less and breathe more, and hate less and love more." The greatest book ever written on co-operation, declared Fra Elbertus, is Maeterlinck's "The Life of the Bee," which points out the lesson that while the individual insect alone is without intelligence or productive ability the collective spirit of the hive shows the greatest instinc-

tive intelligence and reveals that the insect community is close indeed to the secrets of nature.

No man in planning his own success, said Mr. Hubbard, can afford to leave the rest of humankind out of those plans. The badge of sanity is the ability to co-operate with others—the ability to do team work—and the more men one can co-operate with the bigger and better does he prove himself to be. Work, study, play and laugh, advised the Sage of East Aurora, for these mixed in the right proportions and flavored with love give the key to any situation. Courage and ambition, like co-operation itself, are mere matters of psychology.

Having tried everything else, he added, the business world has now adopted the policy of truth. "But when we make a sale," he continued, "let us make a friend." We make money by conferring upon the world service that it needs, but any man who merely chases the rolling disk will soon find that it can attain a fearful velocity and may lead him to ruin or destruction. The man who can make two grins grow where there was one grouch before will be paid generously in the coin of the world. "Cast thy bread upon the waters," quoted Mr. Hubbard, "and," he added, "it will shortly return buttered."

The man who earns less than five dollars a day, he declared, is paying the difference for supervision. The intangible values of assembly, manufacture, transportation and distribution are no less important than the tangible ones of the more ponderable material. The raw products entering into a well-known automobile have, for example, an average cost of about 7 cents a pound, although the finished car is sold at a well-deserved price of 50 cents per pound. The world is willing to pay for such intangible ingredients of genius which can transform raw materials into things of utility and beauty.

For the first time in history, said the Sage of East Aurora, the business man of to-day has had the imagination to place himself in the position of the buyer and to consider the rights of the purchaser as well as his own. The twentieth-century world has adopted the golden rule in business and finds that it pays. And business of to-day has already passed from the feudalistic age of competition to a recognition of the benefits of co-operation.

Election of Commercial Section Officers

The afternoon commercial session's feature was the presentation of the report of the committee on wiring of existing buildings, Part II of which was the special report on the successful handling of the small consumer in Europe printed in the *Electrical World* of May 23. This report elicited considerable discussion.

The nominating committee, composed of Messrs. M. O. Dellplain, J. D. Israel, J. C. McQuiston, F. D. Pendleton and L. R. Wallis, chairman, submitted its report on Thursday afternoon naming its choice of officers for the Commercial Section during the twelve months beginning July 1. This report was unanimously accepted and officers were declared elected as follows: Chairman, Mr. E. L. Callahan, Chicago; vice-chairman, Mr. Douglas Burnett, Baltimore, and Mr. Joseph F. Becker, New York; secretary, Mr. C. A. Littlefield, New York; assistant secretary, Miss Gladys Burkhalter, New York. Executive committee, Messrs. F. D. Beardslee, St. Louis, Mo.; E. A. Edkins, Chicago, Ill.; G. V. Walton, San Francisco, Cal.; J. G. Learned, Chicago, Ill.; H. N. McConnell, New York, and G. Weiderman, Brooklyn, N. Y.

Address of Chairman Freeman of the Hydroelectric Section

In a brief address at the opening of the hydroelectric session, Chairman W. W. Freeman outlined the work performed by the recent Conservation Congress at Washington, D. C. He said that although many points of view were expressed which were not in harmony with association ideas, much good was accomplished by the gathering, and a forward step taken toward the realization of a more constructive policy on the part of the federal government.

Hydroelectic Section Disbands

At the hydroelectric session on Thursday morning Chairman W. W. Freeman announced that the executive committee of the association had reached the conclusion that the dissolution of the section and the possible substitution of a committee upon hydroelectric practice offered a better method of carrying on the work than the present plan. Mr. R. J. McClelland, New York, moved the discontinuance of the section, and the meeting unanimously passed the measure, with the proviso that the subject of hydroelectric development and transmission shall continue to receive due attention from the association through other agencies.

Hydroelectric Development in California

A lecture by Mr. H. J. Lisberger, San Francisco, Cal., describing the system of the Pacific Gas & Electric Company, was given at the hydroelectric session. Numerous lantern slides were displayed, including some recent views of the Panama-Pacific Exposition buildings.

Matters of importance were discussed at the final technical session on Thursday afternoon. The committee on prime movers presented an excellent report and the report of the committee on street lighting was especially interesting marking as it did a more thorough study of the subject than in the past. It is planned to study the psychological aspect of street lighting, and it is proposed to enlist the aid of Prof. Hugo Münsterberg, of Harvard University, in the experiments, particularly in laying out methods of personal observation. Much that is interesting and instructive is expected from these experiments which will be conducted in the Bronx, New York City.

Meeting of Class D Members

The annual meeting of Class D members was also held on Thursday. Mr. J. I. Ayer, chairman of the exhibition committee, made a few remarks on the work of the year, stating that while no great gains were made in membership the Class D membership now totals 250. The thanks of the exhibition committee was extended to the committee having the exhibition in charge, especially to Mr. H. G. McConnaughy, for the excellence and completeness of the arrangements on the roof of the Bellevue-Stratford Hotel.

The following were elected members of the standing committee: Mr. J. I. Ayer, of Boston, to succeed himself; Mr. J. C. McQuiston, of Pittsburgh, to succeed himself, and Mr. C. L. Peirce, Jr., of Pittsburgh, to succeed Mr. H. J. McConnaughy, who as secretary-treasurer is an ex-officio member of the committee.

It was pointed out that at the next year's convention in San Francisco it will not be practicable for Class D members as a body to have an exhibit.

Award of Prizes

At the final general and executive session held on Friday morning Mr. H. H. Scott reported the awards made by the committee on the Doherty Company section medal and other prizes as follows: The first prize, the Doherty gold medal, went to Mr. Harold Goodwin, Jr., of the Philadelphia Electric Company, for his paper entitled "Practical Economies and Distribution with Their Effect on the Commercial Policy of a Central Station Company," read before the Philadelphia Electric Company Section on December 1, 1913. The second prize, the Harriet Billings cash prize, donated by Mr. Arthur Williams, of New York, was awarded to Mr.

H. B. Gear, of the Commonwealth Edison Company of Chicago, for his paper entitled "The Distribution System and the Cost of Electric Service," presented at the November, 1913, meeting of the Commonwealth Edison Company section. The committee said that both of these papers have great merit, and their publication in the regular proceedings of this convention was recommended. Honorable mention was made of the paper entitled "Chestnut Poles," presented by Mr. Thomas Sproule before the Philadelphia Section, April 7, 1913.

Society for Electrical Development

Mr. J. M. Wakeman, general manager of the Society for Electrical Development, Inc., in an address before the final session on Friday morning said that, the necessary funds having been pledged, the staff for carrying out the plans has been selected and the work of the society has been divided into sections, each one in charge of a competent man. Mr. Wakeman then proceeded to outline the plans for the society's activities and concluded his remarks by emphasizing the necessity for a more hearty support of the society and a closer co-operation with it on the part of the central stations. Practically every new use for and user of electricity means additional business for the central station, and Mr. Wakeman pointed out that while the Society for Electrical Development is now active it has not received the support from the central stations to which it is entitled by the importance of its work.

Meter Exhibit

Mr. T. C. Martin as the committee on memorials presented his report. The names of those included were S. R. Anthony, R. D. Apperson, D. M. Barton, A. N. Brady, J. S. Cummins, E. F. Catchings, C. A. Chapin, J. C. Calisch, W. Cooper, R. N. Dyer, W. F. Davidson, M. J. Francisco, W. W. Gamewell, J. E. Hodgson, E. J. Houston, F. V. T. Lee, C. W. Morse, A. S. Michener, L. N. Peart, J. Pass, C. F. Pritchard, H. M. Richards, F. H. Soden, G. Stevens, R. C. Winchester, J. R. Wiley and G. Westinghouse.

In the resolutions adopted, special mention was made of the interest taken in the affairs of the N. E. L. A. by the daily papers published in Philadelphia, the activities of the hotel managers regarding the welfare of the visiting members, and the remarkably complete preparations made for the event by the Philadelphia Electric Company. Thanks were extended to the Franklin Institute, to President Joseph B. McCall and Mr. W. C. L. Eglin, to the McGraw Publishing Company, publisher of the *Convention Daily*, to the technical press, to the various committees and to all those who contributed to the comfort and success of the convention.

Appreciation was also expressed for the interest displayed by Messrs. Thomas A. Edison, Charles F. Brush, Frank J. Sprague and E. W. Rice, Jr., in attending the thirty-seventh convention of the association. Before adjourning, the members in attendance at the convention voted to send a telegram of good wishes to Miss Harriet Billings, assistant secretary and treasurer of the association.

Election of Association Officers

The following officers selected by the nominating committee were declared elected: President, Mr. H. H. Scott, New York; first vice-president, Mr. E. W. Lloyd, Commonwealth Edison Company, Chicago; second vice-president, Mr. H. A. Wagner, Consolidated Gas Electric Light & Power Company, Baltimore, Md.; third vice-president, Mr. L. D. Gibbs, Edison Electric Illuminating Company of Boston; fourth vice-president, Mr. J. S. Bleecker, Columbus (Ga.) Power Company; treasurer, Mr. W. F. Wells, Edison Electric Illuminating Company of Brooklyn; executive committee to serve for three years: Mr. Paul Spencer, United Gas Improvement Company, Philadelphia, Pa.; Mr. A. C. Einstein, Union Electric Light & Power Company, St. Louis, Mo., and Mr. Walter Neumiller, New York Edison Company.

The nominating committee recommended Mr. T. C. Martin as executive secretary.

The newly elected president is one of the youngest men elevated to that rank. Born in Orillia, Canada, Sept. 14, 1874, he emigrated with his parents to Ashland, Wis., in 1882. There he received his early education, graduating from the Ashland High School in 1892, subsequently entering the University of Wisconsin, from which he graduated in 1896, with the degree of B. S. Immediately after receiving his sheepskin he entered the employ of Mr. Henry L. Doherty, who was then connected with the Emerson McMillin Company. His first position was with the Madison (Wis.) Gas & Electric Company, where he was engaged in general work. Four years later he went to Lincoln, Neb., as superintendent of the Lincoln Gas & Electric Light Company, and in 1902 he left Lincoln for San Antonio, Tex., where he was appointed engineer for the San Antonio Gas & Electric Company and the San Antonio Traction Company. He subsequently became general superintendent of the former and assistant to the president of the latter, both companies being at that time part of the American Light & Traction Company's holdings. In the spring of 1905 he returned to Madison, Wis., as general superintendent of the Madison Gas & Electric Company, and in 1906 he went to New York City as chief engineer for Henry L. Doherty & Company and was engaged in examining all the properties taken over and owned by that company. He is at present general manager of the Doherty Operating Company, which operates 104 public utility plants in all parts of the company and is also a director in many of the corporations owned and controlled by H. L. Doherty & Company.

PRESIDENT-ELECT HOLTON HENRY SCOTT

Mr. Scott has worked assiduously as chairman of the organization committee of the National Electric Light Association in making that body in point of membership one of the largest, if not the largest in the world. During the five years in which he has been chairman of the organization committee the membership of the association has increased from 3000 to over 13,000. Mr. Scott has also been a member of the executive committee for three years and has occupied the vice-president's chair for two years. He is a member of the

National Commercial Gas Association, the New York Electrical Society, the National Electric Light Association, an associate member of the American Institute of Electrical Engineers, an honorary member of Tau Beta Pi and a member of the Engineers' Club of New York.

Company Section Co-operation

At a meeting of delegates representing the forty-four company sections, which embrace more than 85 per cent of the total enrolled membership of the N. E. L. A., steps were taken on Wednesday evening to secure, if possible, the appointment of a permanent association committee having jurisdiction over company section affairs. The meeting was called by Mr. Joseph B. Seaman, chairman of the Philadelphia Electric Company Section, who turned the meeting over to Mr. E. A. Edkins of the Commonwealth Edison Company of Chicago.

An extended discussion on section matters, methods of conducting meetings, planning of section work and the difficulties involved, occupied most of Wednesday evening's two-hour meeting of the delegates. Among those who took part in the discussion were Messrs. J. W. Cowles, Boston; E. C. Stone, Pittsburgh; C. E. White, Brooklyn; F. A. Birch, Philadelphia; D. C. Bruce, Baltimore, and F. J. Arnold, Chicago.

Power Sales Club Organized

At an enthusiastic meeting Thursday afternoon plans were made for the organization of a Power Sales Club to be affiliated with the Commercial Section. An organization committee was appointed to perfect the details of the work of the club. It consists of Messrs. Harry G. Glass, R. H. Knowlton, J. J. Hurley, H. H. Holding, S. V. Walton and H. C. Gille. At the close of the meeting a suggestion was made that every influence be exerted to secure at the next convention a session especially devoted to motor-applications business.

Meter Exhibit

The meter committee, in accordance with established precedent, prepared a very attractive exhibit. The display was confined in general to primary and secondary standards and to the new instruments and meters placed on the market during the past year. There were also a number of new and interesting accessories, load boxes, storage battery lamps for meter reading, etc., and a complete exhibit of all the demand instruments and meters now available. Included among the latter were the Pick demand meter, the Ingalls demand recorder and a new model of the Sangamo demand instrument, which while only experimental at present the committee hopes will be produced during this year.

"Safety First" Exhibit

An interesting exhibit of accident prevention devices and literature was maintained at the Bellevue-Stratford Hotel during the convention by the New York Edison Company, United Gas Improvement Company, Rochester Railway & Light Company, General Electric Company, and the Bureau of Safety representing the Commonwealth Edison Company, Public Service Company of Northern Illinois, and Middle West Utilities Company.

N. E. L. A. Welcome Arch

As an indication of its cordial greeting to the National Electric Light Association, the Philadelphia Electric Company placed across Broad Street at the Bellevue-Stratford corner a most conspicuous arch, artistic in design, which excited general admiration. The effect was that of a brilliant necklace of electric lamps supporting a pendant, the whole attached to two graceful wooden pedestals each of which was surrounded by an open-work ball with lamps inside. The pillars reached to a height of 52 ft. The string of lamps crossing the street consisted of twenty-four 1000-watt nitrogen-filled incandescent units, each in a frosted globe. Each of the balls at the top of the pedestals contained four of the same type of lamps. The medallion, or pendant, supported by the "necklace" displayed the well-known emblem of the N. E. L. A., the letters being outlined at night in 25-watt frosted lamps. The entire decoration was designed by Mr. John T. Windrim and was erected and operated by the Philadelphia Electric Company.

Entertainments of the Week

Despite the crowded business program of the convention many of those in attendance found time to share the delightful entertainment features of the week. On Monday a preliminary baseball game for the Westinghouse trophy was played between Philadelphia and Baltimore at Franklin Field, Baltimore winning, 7 to 4. The opening reception by President and Mrs. McCall at the Bellevue-Stratford Hotel on Monday evening was enjoyed by many hundreds of delegates and guests. On Tuesday a sightseeing tour of the city was participated in by the ladies, the trip including visits to Independence Hall, Franklin's grave, Christ Church, Wanamaker's, the Curtis Publishing Company's plant and many other points of interest. In the afternoon the ladies enjoyed a musicale in the auditorium of the Manufacturers' Club. The entire convention adjourned Tuesday evening to Willow Grove Park, where a concert was given by Pryor's Band, and the Jovian Order held a rejuvenation at the same place and time.

On Wednesday morning the ladies enjoyed an automobile trip through Fairmount Park, and in the afternoon the New York Edison Company's baseball team defeated Baltimore, 13 to 1, on Franklin Field, thereby winning the championship cup for this year, each member of the club also receiving a silver loving cup. Wednesday evening a dinner was given by Chairman Arthur Williams and President McCall to members of the public policy committee and other distinguished visitors, Mr. Edison being the guest of honor. On the same evening a delightful card party for the ladies took place at the Hotel Adelphia.

A river excursion for ladies on the steamer *City of Philadelphia* took place on Thursday morning, the trip affording a view of many commercial and historical institutions, including the immense plants of the Cramp Shipbuilding Company and the New York Shipbuilding Company, Fort Mifflin, and the monument that marked the battlefield of Red Bank. The party landed at the League Island Navy Yard, and luncheon was served during the trip, the enjoyment of which was enhanced by orchestral music.

On Thursday evening a dance was held in the Bellevue-Stratford ball-room. On Friday about 200 delegates and guests visited the power development of the Pennsylvania Water & Power Company at Holtwood, on the Susquehanna River, as guests of Mr. Herbert A. Wagner, making the trip by special train.

During the week a number of informal dinners took place, among these being one given for representatives of Stone & Webster in attendance at the convention, and another given by Mr. L. A. Osborne at the Racquet Club to his friends, the guests including President McCall, Mr. E. W. Rice, Jr., Mr. Guy E. Tripp and Mr. Joseph Buffington.

Members and guests were offered the hospitality of the Huntingdon Valley Country Club, the Philmont Country Club, the St. David's Golf Club, the Philadelphia Cricket Club, the Whitemarsh Valley Country Club and the Springhaven Country Club.

Pittsfield A. I. E. E. Meeting

The relative merits of star and delta connections in generators and transformers as viewed by designers and operators was the general subject of a meeting of the American Institute of Electrical Engineers held at Pittsfield, Mass., on May 28 and 29. Prof. D. C. Jackson, President-elect Paul M. Lincoln and President C. O. Mailloux acted successively as chairman of the three sessions.

Experience with Line Transformers

Mr. D. W. Roper, of the Commonwealth Edison Company, Chicago, presented an analysis of troubles encountered during the year ended Dec. 31, 1913, with 14,274 transformers, having a total rating of 129,056 kw, the average rating being about 9 kw. Transformers of 5-kw rating and smaller comprise over 60 per cent of the total number installed. Of the 220 transformer burn-outs recorded, 129 were attributed to lightning, 12 to overloads, 23 to defects, 9 to grounds and secondary short-circuits and 47 to causes unknown. Of the total number of transformers in service, 9878 have connection boards above the oil, and the remainder are without connection boards or are provided with submerged boards. The relative number of troubles encountered with transformers having connection boards above the oil was about twice that with the other transformers.

The author made use of the standard specification for transformers issued by the Bureau of Standards as a basis for discussing possible improvements. He claimed that the standard specifications represent a long step forward in placing the connection boards under oil. As only a small percentage of the transformers that are provided with connection boards are ever used on 1000-volt circuits, the author suggested that a further improvement could be made by requiring that transformers for use on 2000-volt circuits shall be furnished without connection boards and limiting the use of submerged connection boards to those companies which have 1000-volt distributing circuits.

The author remarked that the protection of distributing transformers against lightning has not received the attention it deserves. Records show that the larger sizes of transformers are comparatively immune from lightning, and that the greatest number of troubles occur with the smaller sizes, that is, below 10 kw. The number of transformers of these sizes comes to about 70 per cent of the total installation, so that the transformers which are most susceptible to damage by lightning are the most numerous. It is suggested that careful attention by the manufacturers to the primary bushings, the clearance of the primary leads inside the case, the manner of their support and other minor details would probably result in a material improvement in these records.

For experimental purposes lightning arresters were installed upon the same pole with each of a large number of transformers. The remainder of the distributing system is protected by arresters not placed on the transformer poles but scattered over the lines at a distance of about 2000 ft., resulting in a ratio of arresters to transformers of about 40 per cent. In that portion of the territory where there was an arrester on the same pole with each transformer the results to date as compared with the older practice indicate that the percentage of transformers burned out by lightning is reduced by about two-thirds.

The several experiments indicate that by means of a combination of the two schemes, and possibly by some further improvements in some details of the transformers and in the design of the lightning arresters, there should be no great difficulty in reducing the percentage of cases of trouble due to lightning to one-fifth, and possibly to one-tenth, of those experienced in former years.

Discussion

Mr. W. S. Moody, Pittsfield, remarked that there are many factors that should be taken into consideration in the design of transformers which nothing but service will demonstrate. The manufacturer cannot benefit by experience in service to any great extent without the very complete assistance of the operating man. The manufacturer wishes to make his apparatus just as reliable as possible. It is only by keeping exact records of reliability that the most economical point in the balance of cost and factor of safety can be found.

Mr. A. D. Fishel, Pittsburgh, stated that continuity of service is especially important in a large distributing system. He claimed that remarkable improvements contributing to reliability have been made during the past few years in distributing transformers following the introduction of silicon steel and changes in the arrangement of coils and core. Compared with the earlier types, modern transformers have greater factors of safety in the insulation and more uniform temperature rise, which improvements have resulted in more reliable service. The new transformers have larger clearances at the terminal board than the old and are giving very satisfactory service with the board at the oil level. Such an arrangement would not be permissible at 6600 volts because of the great clearance needed, but it is advantageous at lower voltages.

Mr. H. W. Hough, Cleveland, said that there are about 10,000 transformers in service in Cleveland. About 400 of these were burned out last year. In a great majority of cases exposed terminal boards were damaged. In no case was damage done to a submerged terminal board.

Mr. Joseph Franz, Lenox, Mass., called attention to the fact that in the Berkshire region of Massachusetts it is not always possible to obtain good ground connections in remote sections, and in two instances during lightning storms trouble arose where arresters were on the same pole with the transformers. As a result of a fire caused in this manner the company now places no lightning protectors on the same poles with transformers.

Mr. M. O. Troy, Schenectady, expressed the opinion that the best solution of the terminal-board problem is to be found in its elimination by standardization of the operating voltages. Whenever a terminal board is used it should be submerged and a weak point for lightning path should be provided external to the transformer.

Prof. E. E. F. Creighton, Schenectady, made the following suggestions for protection from lightning: Discontinue the practice of using a terminal board as any sort of protection for the transformer; use an arrester with good protective qualities placed on the same pole with the transformer, utilizing two ground connections where desired; connect the transformer case to the ground terminal of the arrester.

Mr. H. B. Alverson, Buffalo, claimed that a limited number of arresters properly placed will do as much good as many arresters connected with the distributing transformers.

Mr. W. L. Granger, Detroit, stated that exposed terminal blocks cause transformer failures even in the winter time when there is no lightning and can best be eliminated entirely.

Mr. W. J. Wooldridge, Pittsfield, Mass., explained the relation between the attitude of the workman in the transformer factory and the safety and reliability of the apparatus manufactured. The workman must be saturated with the "safety first" idea to insure his

proper attention to details of transformer insulation. Mr. Wooldridge displayed Pittsfield factory accident data curves for 1912 and 1913 and the first three months of 1914, showing that the ratio of the number of accidents to the number of men employed was reduced by about 50 per cent in 1913 as compared with 1912, and has been further reduced by about 50 per cent in 1914 as compared with 1913.

Three-Phase Connections

A paper by Prof. Royal W. Sorensen and Mr. Walter M. Newton and one by Mr. R. C. Clinker dealt with similar subjects and hence were read consecutively and discussed together.

Star and Delta Connections

The paper by Messrs. Royal W. Sorensen and Walter L. Newton, entitled "Inherent Voltage Relations in Star and Delta Connections," was read by Mr. H. W. Tobey. The authors reported the results of experiments made on a small transmission system consisting of a 7.5-kw revolving-field generator and two banks of transformers, each consisting of three 3-kva shell-type units with the necessary interconnecting leads, forming a miniature transmission installation. Tests were made with both star and delta connection without load, with balanced non-inductive load and with non-inductive load on only one phase for various conditions of grounding.

The authors concluded that the complete delta system for generators and transformers with load connected in star is not to be recommended, but that the ideal system is one with the transformers connected in delta and the generators in star.

Triple Harmonics in Transformers

The conditions under which triple harmonic voltages and currents are produced in star-connected and delta-connected transformers were reviewed in a paper by Mr. R. C. Clinker which was abstracted by Mr. H. O. Stephens. These harmonics are produced by variation in the permeability of the core with the cyclic change in the magnetization. In a single-phase transformer increase of series resistance tends to suppress the current harmonic and increase the voltage harmonic. In three-phase transformers a star connection suppresses the current harmonic and allows the full flux and voltage harmonics to appear. Delta connection provides a closed path for the current harmonic and suppresses the triple voltage.

The author cited a case where a star-connected auto-transformer was used to step up from 6600 volts to 12,000 volts at a substation. The neutral was not grounded, and trouble resulted owing to partial resonance at triple frequency between line capacity and transformer reactance. He showed that, although not generally recognized, a triple component can exist in the line-to-line emf wave of a three-phase system. This is possible in a case where a two-to-three-phase transformation is used, and the emf wave of the two-phase generator contains a triple harmonic.

Discussion

In a written communication Mr. Waldo V. Lyon, Boston, pointed out that for the same flux distribution and same phase voltage the third harmonic component is only one-half as great in a two-phase generator as in a three-phase generator. Dr. A. E. Kennelly and Dr. Harold Pender, Boston, submitted a joint written communication in which attention was called to the great increase in voltage rise at the end of a transmission line when the length is such as to equal a quarter wavelength corresponding to one of the pronounced higher harmonics in the voltage wave.

Mr. F. W. Peek, Jr., Schenectady, showed that the third harmonic is produced by variation in the reluctance of the magnetic path and explained the methods by which either the voltage or the current wave, but not both, could be freed from a triple-frequency component.

Mr. Louis F. Blume, Pittsfield, expressed the opinion that, with the present knowledge of the production, effect and elimination of triple-frequency components, there now remains no excuse for permitting the voltage wave to contain a third harmonic.

Mr. Charles L. Fortescue, Pittsburgh, attributed the presence of the triple harmonic in the secondary circuits of Scott-connected transformers receiving energy from a two-phase generator to the dissymmetry in the phases as well as to the distortion in the generator wave-shape.

Mr. J. M. Weed, Pittsfield, stated that change in permeability rather than hysteresis is the cause for the presence of the third harmonic in three-phase transformer groups.

Operation of Three-Phase Systems

In view of the similarity in subject matter, papers by Mr. Louis F. Blume, Mr. Charles L. Fortescue and Messrs. J. P. Jollyman, P. M. Downing and F. G. Baum were discussed collectively.

Transformer Operation

The relative advantages and disadvantages in the operation of the more important transformer connections in three-phase systems were outlined in a paper by Mr. Louis F. Blume, of the General Electric Company, Pittsfield, Mass. In addition to the normal condition of operation, consideration was given to operation with one phase disabled and to operation with grounds on the line. The insulation stresses under normal and abnormal conditions of operation were discussed. As a result of his analysis the author reached the following conclusions: Isolated systems are subject to greater insulation stresses than grounded systems. In grounded systems the average insulation factor of safety is greater than in isolated systems under similar conditions of operation. In isolated systems the stresses at lower frequencies under certain conditions may reach values sufficiently high to injure or destroy the transformer and other apparatus connected to the system. In an isolated system a ground on the line is more likely to result in intermittent arcs than in a grounded system. A ground on the line in a solidly grounded system reduces the potential of the system with respect to ground, whereas in the isolated system a ground on the line increases the potential of the system with respect to ground. A resistance inserted between neutral and ground to limit the value of short-circuit current increases thereby the insulation stresses resulting from line grounds. If it is desired to limit the value of potential at fundamental frequency above ground of any part of the system to 57 per cent of line potential, it is necessary to ground the neutral solidly at both the receiving and the generating end of the transmission line. If receiving transformers of relatively small kilovolt-ampere rating are connected with grounded neutral to an otherwise isolated system, they are liable to severe short-circuits, and the grounded neutral only partly protects the system from potential rises. In star-connected auto-transformers it is dangerous to operate with isolated neutral except when the ratio of transformation is very small. In star-connected auto-transformers it is dangerous to operate with isolated neutral except when the entire system is isolated. In star-connected auto-transformers it is dangerous to operate with grounded neutral unless the triple harmonic voltage between line and neutral is eliminated or kept negligibly small.

Study of Three-Phase Systems

Mr. Charles L. Fortescue read a paper relating to the advantages and disadvantages of the several common methods of connecting transformers in three-phase systems, including the "star-star," the "delta-delta," the "star-delta" and the "delta-star." The paper contained a list of thirty-seven systems operating at or above 70,000 volts, similar to the table which was issued as a supplement to the *Electrical World* on April 25, 1914. In twenty-two of these systems use is made of the star connection of transformers on the high-tension side.

The author expressed his belief that for pressures below 44,000 volts either star or delta high-tension transformer connection may be used. The delta connection has a slight advantage owing to its greater flexibility. For higher voltages the star high-tension connection is preferable, chiefly on account of its greater strength and lower cost. There is a probability that a delta-star bank of transformers will cause less disturbance in switching than one that is delta-delta-connected. There are much greater possibilities of development in transformers designed for delta-star connection than for any other. Past and present practice upholds the use of the delta-star connection in preference to the delta-delta for high-voltage transmission.

Experience with Grounded Neutral

A paper by Messrs. J. P. Jollyman, P. M. Downing and F. G. Baum, entitled "Experience of the Pacific Gas & Electric Company with the Grounded Neutral," was read by Mr. V. M. Montsinger. The system of this company is operated at 60,000 volts with star-connected transformers and solidly grounded neutral at all generating stations and the important substations.

As a result of its experience the company believes that the grounded-neutral system has a number of important advantages with regard to the transformers, the transmission lines and operation. The fewer turns of larger size of the star-connected transformers with fixed lower average voltage to ground greatly increases their reliability. The maximum voltage on the line insulators with the grounded neutral is never more than 57.7 per cent of the line voltage, and it is possible to maintain polyphase service at a substation on a branch line with only two wires in case one wire should be cut out. This cannot be done on a delta system unless one phase of the system be grounded, which is very undesirable. With a grounded neutral the falling of a wire is instantly detected and power must be shut off. In a delta-connected system the formation of an arcing ground is often followed by surges which break down the insulation at other points, the cause of this disturbance being the oscillatory character of the arc. In the grounded star-connected system no such disturbances occur, as the frequency of an arc to ground is the same as that of the system and any damage is confined to the point of failure.

The authors expressed the belief that operation with the grounded neutral causes less disturbance in telephone and telegraph lines than would be the case in delta-connected lines.

Discussion

In a written communication Mr. Guido Semenza, Milan, Italy, stated that in Italy, which has an area about double that of the State of New York, there are more than 2400 hydroelectric generating stations nearly all of which are provided with transmission lines. The great majority of the systems are delta-connected without grounds; a few are star-connected with spark-gap to ground, a few are connected to ground through resistance, while only two are directly grounded. Of the underground high-tension lines not one is operated with grounded neutral.

Mr. Semenza gave the following résumé of the reasons usually assigned for the Italian practice: With good circuit-breakers a ground on one line will always result in an interruption of the other lines. Grounding through a resistance is an immediate solution which presents the disadvantages of both insulated and grounded systems. Directly grounded neutrals are apt to disturb all low-current circuits. The practice in Italy is to over-insulate the lines. One of the most serious disturbances on long-distance transmission systems is the traveling surges caused by atmospheric influences. It is said that a grounded neutral prevents the accumulation of static charges. In many Italian systems this accumulation is prevented by water-jet dischargers acting on the busbars or on the line wires.

Mr. Semenza stated that he did not see many reasons for supporting the grounding of the neutral, while he saw many reasons for not doing so. By using good insulation and good terminal protection the insulated system affords all the conditions needed for good and regular operation.

Mr. W. W. Lewis, Pittsfield, called attention to the transmission-line data published in the *Electrical World* dated April 25, 1914, relating to thirty-five American and nineteen foreign systems operating at and above 70,000 volts. Of the American systems fourteen are delta-connected and nineteen star-connected, all but one of the latter having grounded neutrals. Of the foreign systems six are delta-connected and ten star-connected, six having grounded neutrals.

Mr. Lewis discussed in detail the operating conditions of six typical systems: the Great Western Power Company with isolated delta; the Colorado Power Company with isolated delta; the Au Sable Electric Company with isolated delta; the Sierra & San Francisco Power Company with grounded star; the Yadkins River Power Company with grounded star, and the Pennsylvania Water & Power Company with grounded star. He concluded that neither the isolated delta nor the grounded star system is free from trouble, which is governed largely by location, climate and mechanical details of line construction.

Two arguments which are frequently used in favor of the isolated delta system are proved in practice to be fallacious, namely, that only voltage troubles need be expected and that a delta system can operate continuously in case of a dead ground on one line. The latter is true only for very short lines, as on long lines the charging current—due to the increased capacity and voltage—becomes excessive, as does also the corona loss. The telephone system is also invariably disturbed, and hence operation must usually be discontinued. On the other hand, the short-circuit troubles on the grounded star system are very severe, and some auxiliary short-circuiting and field-destroying devices are almost essential to render the operation satisfactory. As far as operation is concerned, it seems that each system has its advantages and defects, and that in selecting a system the location and climatic conditions should be carefully considered.

Mr. V. M. Montsinger, Pittsfield, displayed a series of lantern slides recording the results of an investigation of the effect of electrostatic capacity reactance on third harmonic phenomena in star-connected transformers. The third harmonic was found to reach its maximum at a certain value of core density largely independent of the amount of capacity in circuit, the magnitude of the harmonic depending, however, on the capacity. These relations were demonstrated by tests made upon transformers in the lecture room, the meter readings being projected on the screen before the members assembled.

Mr. H. S. Osborne, New York, announced that so far as concerns the disturbance in neighboring telegraph and telephone lines, the delta-connected system is preferable to the star-connected system. It is not felt, however, that any one is now in a position to state finally and authoritatively the extent to which the disturbances can be reduced in these two systems and the amount of disturbance which must necessarily be experienced from them. Without precautions being taken to reduce the interference, the disturbance from either type of system can be very serious, as the telephone companies can abundantly testify.

The joint committee on inductive interferences in California is now carrying out an extended investigation on the entire subject of inductive interferences, and it is to be hoped that the comparative study of the relative possibility of minimizing the inductive effects from star-connected and delta-connected systems will be of great value.

Prof. E. E. F. Creighton stated that the electromagnetic disturbance is a greater menace to telephone lines than is the electrostatic, especially in railway circuits, because of the great depth to which the return current penetrates.

Mr. John B. Taylor, New York and Schenectady, remarked that the star connection of transformers does not inherently mean grounded neutral. In general, the difficulties which may arise from grounding the neutral result from grounding at more than one point. Many of the advantages of the grounded neutral are perfectly well secured with the single ground, and many of the disadvantages are thereby avoided. With extra high-voltage work it seems best to use star connections with the neutral grounded at one point only, the generating station.

Mr. F. C. Green, Pittsfield, presented arguments to show that, since with the isolated delta system an "arcing ground" tends to produce high-voltage disturbances and hence to cause the transformers to break down, this system is not safer to the line or transformers than is the star-connected system.

Mr. D. W. Roper, Chicago, stated that much trouble arose when the transformer neutrals were grounded to the system neutrals in Chicago, and the present practice there is to connect the three transformers of a customer in star, leaving the neutral of the transformers entirely free from the neutral of the system.

Mr. F. W. Peek, Jr., Schenectady, expressed the opinion that the most important point in a transmission system is the insulation of the line. The insulators should be so designed as not to act as weak points in the system which should be confined to the lightning arresters. The insulation should be designed with reference to the abnormal voltage which will cause damage—such as that of lightning—rather than the normal operating voltage of the system.

Star and Delta Connections for Alternators

Mr. T. S. Eden, of the General Electric Company, Schenectady, N. Y., presented a paper entitled "Relative Merits of Star and Delta Connection for Alternators," in which it was stated that over 90 per cent of three-phase generators are star-connected.

The delta connection seems to have no advantage except when used for convenience in design for certain voltages when proper precautions must be exercised to eliminate excessive circulating currents, the triple harmonic voltages being in time-phase with each other.

In a star-connected machine with ungrounded neutral it is impossible for currents of triple frequency or multiples of triple frequency to flow, since the third harmonics existing in the two legs of the winding which are in series between a pair of terminals are opposed to each other and of equal value, thus neutralizing one another.

With the star connection it is possible to bring out a neutral lead for various uses, while the required voltage is obtained with 58 per cent of the turns required with delta connection. This is a large factor in cost, especially in machines of high voltage and large numbers of turns per coil, where the expense of internal insulation increases rapidly.

In general, for the average alternator, the emf wave of the star-connected winding is nearer a true sine than that of the delta-connected generator.

Transformer Connections for Railway Service

Mr. Cassius M. Davis read a paper on delta and star connections for railway transmission and distribution, in which he stated that the choice between the two is frequently determined by purely economic consideration. However, it is common practice to use the delta connection on both the high-tension and the low-tension sides of transformers except in the case of six-phase converters, where the diametrical connection on the low-tension side is the rule. Synchronous converter substations employing two machines in series for high-voltage direct-current railways are frequently operated from single banks of transformers which have double windings on the low-tension sides. Methods of starting have little effect upon transformer connections except in the case of six-phase converters. Transformer connections are seldom important electrically in single-phase and three-phase railway systems. A secondary distribution system may at first be delta-connected and later changed over to star connection to obtain better voltage regulation.

The author stated that the low-tension sides of substation transformers are usually delta-connected, except for six-phase synchronous converters and except where specific local conditions demand a star connection for reaching the neutral point. Six-phase synchronous converters are usually supplied with energy from delta-diametrical connected transformers. The choice of connection for low-tension distribution systems between substations is largely dependent upon commercial economy rather than upon purely electrical considerations.

Discussion

Mr. Carl J. Fechheimer, Ampere, N. J., mentioned the fact that for a large low-voltage machine, such as a 2000-kva, 240-volt generator, the delta connection is preferable to the star connection. Moreover, for certain voltages it is better to use the delta than the star arrangement on account of the number of conductors required in the slots. The circulating current in delta-connected windings caused by distortion in the voltage wave can be reduced not only by using a two-thirds pitch but also by inserting reactance in the winding and by carefully designing the pole shoes. The effect of the circulating current upon the efficiency is of less importance than its effect upon the temperature rise.

Mr. E. G. Merrick, Schenectady, explained that in modern turbo-generators the equivalent of non-uniformity in the depth of the air-gap is obtained by varying the ratio of the wound to the unwound portion of the revolving field structure.

Summary of Program

At the conclusion of the presentation and discussion of the formal papers on the program, the subject matter as a whole was reviewed by Mr. Percy H. Thomas, New York, who outlined the methods by which triple-frequency voltage and current waves are produced in three-phase systems, explained their effect upon the operation of the system and showed how so to minimize or localize their activities as to render them harmless.

National District Heating Association Has a Good Year

The sixth annual convention of the National District Heating Association, held in Rochester on May 26-28, closed a year marked by a decided increase in membership, greater financial strength and effective committee work. President S. Morgan Bushnell, of Chicago, presided, and the experienced secretary-treasurer, Mr. D. L. Gaskill, of Greenville, Ohio, looked after details. The attendance was about 140, and a few manufacturers made exhibits. At the opening session Mr. Charles S. Owen, commissioner of public safety of the city of Rochester, made an address of welcome, to which Mr. Fred B. Orr, of Chicago, responded.

President Bushnell's Address

The presidential address of Mr. Bushnell was well considered. The speaker sketched the rise of electric-light companies and showed how there gradually arose the demand that central-station companies give a complete service—light, power and heat. It would be desirable, no doubt, if electricity could be the agent to supply all these utilities, but Mr. Bushnell gave calculations to show that at prevailing commercial rates the relative cost of heating buildings by steam and electricity would be as 1 to 11.8. In other words, electric heating for buildings would cost over ten times as much as steam.

Central-station heating possesses several advantages—cheaper coal can be burned in more efficient plants; its convenience and labor saving are very attractive to the householder; it helps abolish the smoke nuisance, and, also important, it helps the central-station manager to combat the isolated electric plant. It is difficult to set any limit to the development of central-station heating. When electric-lighting companies were established, no one could foresee how important would become the supplying of electricity to motors. Similarly, the supplying of heat from the central station may outstrip both light and power. The association has grown to a membership of 300. It has a place in collecting information and studying the district-heating problem scientifically. It works harmoniously with the American Society of Heating and Ventilating Engineers, to which it sustains much the same relation that the National Electric Light Association does to the American Institute of Electrical Engineers. Mr. Bushnell concluded by emphasizing the importance of high-grade work.

Professor Hoffman Made an Honorary Member

Secretary Gaskill read his report, showing the good record of the year. He praised President Bushnell for the impetus he had given the society, saying that he had secured more new members than any other person.

On recommendation of the executive committee, Prof. James D. Hoffman, of the University of Nebraska, formerly of Purdue University, was elected an honorary member, the vote being unanimous. Professor Hoffman is a mechanical engineer, and this distinction is in recognition of his work on district heating.

Underground Construction

As chairman of the committee on the subject, Mr. H. A. Woodworth, of Indianapolis, read a long and valuable report on "District Heating Distribution Systems." The speaker gave some interesting chapters from the district-heating history of the Merchants' Light & Heat Company, of Indianapolis. Among other things he said, in the discussion, that it had been found necessary to re-insulate the whole hot-water heating system in Indianapolis.

Mr. John F. Hale, of Camden, N. J., was introduced as a past-president of the American Society of Heating and Ventilating Engineers. He complimented the association on its work, but urged the members to "get somewhere" on each subject. Messrs. A. C. Rogers of Toledo, D. S. Boyden of Boston, Thomas Donohue of Lafayette, Ind., Henry Meyer of Terre Haute, Ind., and others took part in the discussion on Mr. Woodworth's report.

The New Officers

The report of the nominating committee, subsequently followed by election, was presented on the evening of May 26. These are the new officers: President, Mr. H. R. Wetherell of the Central Illinois Light Company of Peoria, Ill; first vice-president, Mr. D. S. Boyden of Boston; second vice-president, Mr. Byron T. Gifford of Grand Rapids, Mich.; third vice-president, Mr. George W. Martin of New York; secretary-treasurer, Mr. D. L. Gaskill of Greenville, Ohio; executive committee, Messrs. S. Morgan Bushnell of Chicago, H. Almert of Chicago and C. F. Oehlman of Denver.

Mr. H. S. Patterson, New York, of the National Tube Company, displayed interesting motion pictures showing the manufacture of steel pipes and tubes from the digging of the iron ore to the testing of the finished product.

Giving the Public a Square Deal

Mr. R. M. Searle, vice-president of the Rochester Railway & Light Company, gave an instructive address on "Public Policy of Utilities" at the morning session of May 27. He spoke of the pleasant and reasonable attitude of the public in Rochester toward the utilities. Criticism of utility operation is inevitable; constructive criticism should be welcome. What is needed by the utility, in other words, is "knocks without knocking." The manager should not forget that the public may give practical engineering advice that the company would be willing to pay for. Utility men should discuss matters with their public on a human-being basis.

Mr. Searle spoke of the "five magnificent newspapers" of Rochester. Any man in his organization is authorized to talk to any newspaper man about any news happening, including accidents, provided he tells the truth. The newspaper men know of this policy and appreciate it. There is no reason why any employee should fear to make any truthful statement in relation to utility matters. As to municipal ownership, the speaker made the remark that the waste during the political changes of a long term of years would invariably be more than the profit asked by the corporation. Any taxpayer can participate in the profits of the utility by buying one share or more of its stock. In this way it is probable that he will get greater benefits than he could by the possible reduced taxation of municipal operation. Incidentally, to show the good feeling toward utility men in Rochester Mr. Searle mentioned the fact that he is a former president of the Chamber of Commerce. As an officer in sixteen companies and serving on forty-four civic or other committees, the manager of the Rochester company finds plenty to do.

The speaker expressed himself as a firm believer in government regulation. As one incident, showing the relation of the public and utilities in Rochester, he told of the method adopted to take the poles off the streets in residence districts by securing pole rights in the shape of easements over the rear ends of lots, Rochester having no alleys between streets. Mr. Searle also made the statement that in the public utility business if the public is kept in ignorance it is because the utility men keep it ignorant. Much money will be needed to finance the district-heating extensions of central-station companies in Rochester and elsewhere.

Mr. Searle believes that in the case of his own city the securities issued for this purpose will practically all be placed in the home town. This indicates the local feeling toward the utility, and this feeling is a very desirable asset.

In concluding his talk the Rochester manager argued strongly against the one-man idea of administering utilities. The subordinates should be the right kind of men to make decisions on all ordinary matters. They should be trusted by the chief executive and handle all detail. They should have sufficient authority to give positive answers to customers. Monopoly is a great opportunity to do good, said Mr. Searle. "But never forget," said he in effect, "to dwell on the fact that good honest service is worth a good fair price. To give the elasticity and service that the public demands and is entitled to receive, the contract price should include something for reserve."

Meters for Central-Station Heating

Mr. A. D. Spencer, of Detroit, presented the report of the meter committee, giving some data on the performance of steam-flow meters and condensation meters. One conclusion arrived at by the committee was that thermostatic regulation cannot supplant the metering of steam service. Messrs. Gaskill, of Greenville, Ohio; Rogers, of Toledo; Boyden, of Boston; Orr, of Chicago; Wetherell, of Peoria; G. D. Bly, of Toronto; Hale, of Camden, N. J., and others, took part in the discussion. In Ohio it is required that water of condensation shall not be discharged into sewers at a temperature higher than 140 deg. Some of those present thought that 150 deg. should be allowed.

Station Records

Mr. A. P. Biggs, of Detroit, presented the short report of the station record committee. He also exhibited a number of blanks and forms collected by the committee. This report was discussed by Messrs. Whitney, of Boston; Hecht, of Chicago, and Boyden, of Boston.

Centrifugal or Reciprocating Pumps

Mr. A. C. Rogers, of Toledo, opened the discussion on the relative merits of centrifugal and reciprocating pumps for hot-water heating. He said that further investigation is needed, and for his part he would not recommend one type to the exclusion of the other. There was some discussion. Mr. Hecht, of the Public Service Company of Northern Illinois, said that his experience would indicate that the centrifugal pump is not only more economical as far as maintenance is concerned but is also more economical in the matter of steam consumption. Messrs. Boyden, Wolls, Woodworth and others discussed the report briefly.

Hot-Water Heating

Mr. Thomas Donohue, of Lafayette, Ind., gave a short talk on "Hot-Water Heating Under Forced Circulation." He took up the question of pumping and spoke of the flexibility and efficiency of hot-water heating. He dwelt on the need of paying attention to conditions in customers' premises. This will be found to effect economy in pumping. Mr. L. B. Shaw, of Chicago, described and illustrated a method of caring for the combined hot-water and electric load in a generating station.

Superheated Steam in the Heating System

A short paper on "Effects of Superheated Steam on the Heating System" was read by Mr. Davis S. Boyden, of Boston. He contrasted the advantages and disadvantages of superheat for this service and concluded, considering economy alone, that the preponderance seemed to be slightly with the superheated steam. Messrs. C. R. Bishop, of North Tonawanda, N. Y.; Spencer, E. L. Wilder, of Rochester; Orr, and others, participated in the discussion.

Some Aspects of Government Regulation

Mr. D. L. Gaskill, of Greenville, Ohio, gave a short talk on utility regulation. He declared that nearly all the troubles of the utility are its own fault. If it has conducted its business so that the public has faith in it, it need not fear control by some governmental body. Politicians and agitators cannot exploit the utility unless they have something to work on. The public should be educated as to the cost of district heating. It is very important that utilities should know their real costs, but perhaps 90 per cent of them do not. If an honest record of costs can be presented to the state commission, the utility has little to fear. Mr. Gaskill told how the Ohio Electric Light Association had stood back of the Bucyrus Light & Power Company in the initial valuation case of the Ohio state commission. In relation to the appraisals asked of all Ohio utilities by August 1, the secretary said that the state commission has consented to extend the time. The O. E. L. A. has an appraisal committee at work; that committee has an office in Columbus and will probably be busy for two years.

Mr. Donohue told something of the commission situation in Indiana, and Mr. Rogers, of Toledo, said that as the result of his personal experience with the Ohio commission he is confident that one going to the commission with clean hands will receive fair treatment.

District Heating for Small Towns

Mr. L. T. Mason, of Hornell, N. Y., read a short paper on "District Heating for Small Towns," in which he said that in many circumstances combined electric and steam-heating plants will pay a satisfactory return in small communities. Mr. Wetherell, of Peoria, Ill., took part in the discussion and Mr. Gaskill gave a forcible description of the manner of levying taxes on utilities in Ohio.

Intermittent Operation of Plants

The question whether it is more profitable to shut off steam at night or to keep it on continuously was taken up in a paper read by Mr. E. L. Wilder, of Rochester. The author said that as the results of observations in connection with the central-station heating of several factory buildings he had been led to the conclusion that a saving of from 10 to 30 per cent may be effected by the method of intermittent heating—that is, shutting off the heat during certain hours at night. Mr. Woodworth, of Indianapolis, mentioned some tests where when the thermometer outside stood at 25 deg. or less the heating was done continuously, but above that point the heat was shut off for part of the night. This resulted in a saving of 22 per cent. Mr. Wetherell, of Peoria, described some interesting experiments with a theater where intermittent heating was successfully practised. Others taking part in the discussion were Messrs. Boyden, C. H. Spiehler, of Dayton; Mason, Bly, R. C. Marsh, of Chicago, and others.

Heat Losses from Buildings

A contribution on "Heat Losses from Buildings of Latest Construction," from the pen of Mr. J. Byers Holbrook, of New York, was read by Secretary Gaskill. There was no discussion.

Economic Advantages of Central-Station Heating

Mr. A. C. Rogers, of Toledo, opened the discussion on "Economic Advantages of Central-Station Heating Service Over Individual Heating Plants." He pointed

acting-president. Much good work has been done in

out that the expense of operating an individual heating plant is considerably greater than the fuel bill alone. District-heating men should assume more direct responsibility for installing heating equipments on customers' premises. Mr. Wetherell remarked that on flat rate his company offered heating service in Peoria on the basis of twice the customer's heating bill. However, the cost may be made much less if the consumer will buy steam on a meter basis and regulate the consumption carefully in accordance with actual requirements. Mr. Wolls spoke of one case where central-station heating had practically eliminated pneumonia in a state institution in Columbus, Ohio, caring for children. Mr. Bishop told of an instance where by metering separately the tenants in an office building the receipts for district heating were increased from about 33 cents to about 80 cents per 1000 lb.

Customers' Steam-Heating Systems

The paper by Mr. H. R. Wetherell, of Peoria, on "Customers' Steam-Heating Systems," described several interior-heating systems as used on customers' premises and connected to central station service. In the discussion Mr. Woodworth, of Indianapolis, said that his company was having better success with the vapor system than with the cooling coils. Mr. R. P. Bolton, consulting engineer, New York, declared that the man who could devise a method of measuring steam-heating service as electric service is measured would confer a great benefit on the industry. Messrs. F. M. Noecker, of Renovo, Pa.; R. C. Marsh, of Chicago, and A. C. Rogers, of Toledo, also took part in the discussion.

Commercial Steam Heating in New York City

Mr. George W. Martin, vice-president of the New York City Service Company, read a paper on "Commercial Steam Heating in New York City." He described the methods employed by his company. In the discussion Mr. Bolton spoke of the cost of labor in the firing of coal. Sometimes the waste in the boiler room is almost incredible. Figures given by Mr. Bolton showed that the labor cost alone for firing in heating plants in commercial buildings in New York City ranges from 56 cents to 86 cents per ton of fuel handled. In government buildings this figure is larger, ranging between 86 cents and $1.31. In one city building (Tombs prison) the labor cost for firing was $1.74 per ton of fuel handled, while in another (police headquarters) this cost reached the astonishing figure of $3.59, or 19 cents a ton more than the cost of the fuel itself. Mr. Bolton pointed out the field for the intelligent operations of a service company. He also suggested the establishment of preferential rates to encourage the use of the district heating company's steam in summer. He recommended the use of an indicating steam meter for each boiler.

Mr. D. S. Boyden, of Boston, remarked that without full knowledge of conditions of plant and fuel used figures of labor cost of firing may not mean very much. Mr. Orr, of Chicago, said that apparently it required the burning of about twice as many tons of coal to heat buildings in Chicago as in New York. This is probably due to local conditions, such as colder winters and higher wind velocities. Mr. Orr remarked that up to 900 tons of coal a month there is no advantage in using stokers, so far as labor is concerned. Mr. C. R. Bishop, of North Tonawanda, N. Y., pointed out that in estimating costs the length of the heating season should be taken into consideration.

Rate Making for Heating Companies

The report of the rate committee was presented by the chairman, Mr. E. L. Wilder, of Rochester. The committee said that rates for heating should be placed on a logical basis. It recommended a two-rate charge for steam heating, based in a general way on the maximum demand and the demand charge for steam. In the case of a hot-water plant the committee said that but one charge could be made, owing to the lack of a suitable meter for measuring the service rendered In the discussion Mr. Rogers, of Toledo, said that in a district-heating case in Ohio the Public Utilities Commission of that State had virtually justified a readiness-to-serve charge. Mr. W. G. Carlton, of New York, mentioned the fact that in the hot-water heating supplied to the New York Central Terminal what is in effect a metered system has been adopted. This method of charging is based on volume and temperature of the water. Mr. Bishop pointed out that higher rates for central-station heating may bring about economy, with sliding scales, for customers will be more careful when they are finally shown that they will gain by it. Mr. Donohue, of Lafayette, Ind., said that the flat rate for hot-water heating varies from 15 cents to 24 cents per square foot of radiation. Messrs. A. D. Spencer, of Detroit; R. C. Holley, of North Tonawanda, and others took part in the discussion. In closing Mr. Wilder said that the sale of heating service is not essentially different, so far as rate making is concerned, from electric service, since similar principles govern both.

Economies in Station Operation

In the absence of Mr. Byron T. Gifford, of Grand Rapids, Mich., chairman of the committee, the long and valuable report on station operating was abstracted by Secretary Gaskill. It contained contributions by Messrs. E. C. Fisher, D. S. Jacobus, Joseph Harrington, F. F. Vater, and others, relating to boilers and general operating conditions. In the discussion Mr. Martin, of New York, praised the report and made the point that if feed water is to be treated it should be treated before it gets into the boiler. Mr. Bolton referred to the importance of furnace settings and combustion chambers of sufficient size. He said that he thought the boiler of the future would have vertical tubes. He urged the members to give the association information about their unit cost. Mr. J. L. Hecht said that the Public Service Company of northern Illinois has placed a fuel engineer in the boiler room of each of its large stations. These are technically educated men, and the company estimates the return on them as fifteen to one. Mr. Hecht thinks that firemen should rank above water tenders, the duties of the former being of a more responsible kind.

Information About Franchises

Mr. Charles H. Green, of New York, the subject of franchise forms having been brought up, mentioned Mr. Delos Wilcox's book, as being of possible value to those seeking this information. A number of members told what they paid annually for their franchise rights.

Work of the Educational Committee

Mr. Davis S. Boyden, of Boston, presented the report of the educational committee, which has co-operated with a similar committee of the American Society of Heating and Ventilating Engineers. Subjects like pipe sizes, steam meters, proposed flange standards, weather stripping, accident prevention and first aid, low-pressure steam cooking and meteorological conditions were discussed in a report of seventy-one printed pages. The committee was continued, and the National Electric Light Association and the American Society of Mechanical Engineers were invited to co-operate.

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Visits and Entertainments

Pleasant entertainment was provided for the ladies, and the men had an opportunity to visit plants of the Rochester Railway & Light Company and the Taylor Instrument Companies. There were also a theater party and an informal dance, and on May 29 the American District Steam Company entertained the entire party of 140 in a 300-mile all-day trip to Niagara Falls and return.

Entertainment by the American District Steam Company

On Friday, May 29, the day following the last regular business session, the delegates were the guests of the American District Steam Company, of North Tonawanda, N. Y. At 9:30 a.m., in the New York Central station at Rochester, they boarded a special train, composed of five Pullmans and a club car, every convenience being provided. The first stop was made at Lockport, the home of the original central-heating plant. The entire party was conveyed through the principal residential and business districts of the city, including a visit to the heating plant on Elm Street, by large motor-driven sightseeing trucks. A luncheon was tendered by the company at its works in North Tonawanda. Then followed an inspection of the large plant devoted to the manufacture of materials for use in the construction of central-heating plants. Subsequently the trip was continued to Niagara Falls, where a ride was taken in special cars around the scenic gorge route. Thence the party went to the Cliffton House, on the Canadian side, for dinner, which was served about 7:30 p.m. At the close of dinner Mr. D. L. Gaskill, secretary of the association, expressed for those present their appreciation of the hospitality extended by the company and commented upon the way in which every part of the scheduled program had been carried out. Mr. Wells, president of the company, responded in a brief talk and made it apparent that the company's reward lay in the appreciation manifested on all sides. Dancing was then indulged in until 10 p. m., when the return trip to Rochester was made, by way of Buffalo.

Convention Cruise of the Missouri Utilities Association

Leaving St. Louis on the morning of May 21, the delegates of the Missouri Electric, Gas, Street Railway & Water Works Association enjoyed a three days' trip on the Mississippi River. Keokuk, with its 150,000-hp hydroelectric development, was the objective point of the steamer *Quincy*, on board which all convention sessions were held. In the absence of President J. E. Harsh, formerly of Sedalia, and First Vice-president C. L. Clary, formerly of Sikeston, Second Vice-president A. C. Einstein, of St. Louis, presided. Business-like sessions and a maximum of wholesome entertainment and outdoor enjoyment marked the convention from beginning to end.

On the afternoon of May 21 communications from Messrs. John M. Atkinson and J. M. McShane, of the Missouri Public Service Commission, were read by Mr. J. D. Bowles, one of the commission's engineers. Reflecting the fair, judicial attitude of the newly created commission, these letters indicated that the problems will be squarely met, and in the decisions rendered the viewpoints of the people and the utilities will both be considered.

Growth of Missouri Association

During the last year the Missouri Gas, Electric, Street Railway and Water Works Association has grown and prospered, said Mr. Einstein in his address as acting-president. Much good work has been done in co-operating with the Missouri Public Service Commission to secure an acceptable classification of accounts. Since the coming of the commission utility men have had much to learn, and even yet among the smaller utilities the importance of the working of the commission is hardly comprehended. However, conferences attended by members of the commission and the association have resulted in giving the commission a thorough understanding of conditions, and it is the commission's desire to inaugurate a system of accounting which will be neither onerous nor burdensome to the small companies, and yet at the same time will be a practical subdivided system for the larger companies.

Work for the future was mapped out by Vice-president Einstein as follows: A committee on public affairs should be created; small companies should have a uniform form of rate schedule; the association should request the Missouri Public Service Commission to withhold action on joint pole construction, as the National Electric Light Association standards at present need qualification in many instances on account of the fact that the N. E. L. A. specifications for 1911 were made up largely from data supplied by telephone and telegraph companies and that their use works a hardship on the lighting companies. In closing Mr. Einstein suggested that action be taken to incorporate the association.

In the executive session following Mr. Einstein's address the membership committee reported a total of 115 members in good standing. The report of the treasurer showed that the association was in comfortable financial circumstances. Other committees reporting were the executive committee, special committee and new by-laws committee. Embodied in the report of the latter was a new set of by-laws providing that the society be incorporated under the name of the Missouri Public Utilities Association. Member grades were also changed, the annual dues of member companies as finally amended ranging from $5 to $250.

Indeterminate Permit

Presenting a paper on "Complete Regulation Under the Indeterminate Permit," Mr. William J. Norton, of Chicago, declared himself to be a firm believer in the indeterminate permit as the solution of franchise and regulatory problems, especially those of small plants. Regulation in Missouri, said Mr. Norton, is now incomplete. The commission has the power under the public service commission laws to require municipalities to file their rates and contracts and complete reports as to operation, and also the right to fix the price to be charged by municipalities as well as by private corporations. However, citizens are left to decide such matters of vital importance as the prevention of unnecessary competition and duplication of private utility properties at the hands of municipal authorities. Sketching the history of the indeterminate permit in Wisconsin, Indiana and Massachusetts, the speaker pointed out the advantages to be gained from a franchise extending for an indefinite period during good behavior, so to speak, over one which expired at the end of a definite period of years. In decisions and public addresses the Wisconsin commissioners have discussed various features of the indeterminate permit and pointed out the advantages accruing to the company and the public. In the Appleton case the commission held that the indeterminate permit is "more valuable than the ordinary special franchise because the company now is a legally protected monopoly and is subject to no different supervision and regulation than it would have been had it continued to operate under its original grant. Furthermore, its investment is now

protected not only against the consequences of competition but also against the possibility of total loss on expiration of the original grant. It can never be deprived of its property except on payment of fair value therefor by the municipality."

Those discussing the paper were Messrs. I. R. Kelso and J. P. Kealy, of Kansas City; J. N. Chester, of Jefferson City, and A. C. Einstein, of St. Louis.

Visits to Member Companies

Last October the executive committee of the association delegated Mr. John C. Hall, of St. Louis, to make a trip throughout the State, calling on various utilities for the purpose of explaining the Public Service Commission by-laws and incidentally to secure new members for the association. Most of the time of the special representative was spent with the smaller or independent companies on the assumption that the syndicate companies were better able to care for themselves. The representative reported that what the small company needs is time to prepare its affairs, as it is unreasonable to expect the small company to grasp the entire situation at once. Even the large companies had to digest the public service commission laws a little at a time. The general impression prevailing throughout the State, according to Mr. Hall, is that Missouri has a good public service commission law and commission. The only existing fear—and this is especially true among the smaller utilities—is that they will not be prepared to comply with all the commission's orders and rulings when issued.

Classification of Accounts

Mr. P. J. Kealy, Kansas City, chairman of the committee co-operating with the Missouri Public Service Commission on classification of accounts and annual reports, stated that the work was progressing, a tentative draft of the forms for electric and gas companies now being in the hands of Commissioner McShane. This classification follows quite closely the N. E. L. A. draft to be submitted at the Philadelphia convention. After commenting favorably upon the fair and receptive attitude of the commission Mr. Kealy predicted that the final draft of the classification would satisfy every utility operator in the State. The matter of depreciation and bond discount, however, is still an issue with the commission.

At the close of the afternoon session Mr. C. H. Jaccard, of Webb City, presented a paper entitled "Meters Versus Flat Rates on Water," setting forth arguments in favor of selling water on the metered plan, eliminating the guessing incident to all flat-rate schedules.

Effecting Economies in a Small Plant

The first paper of the session on May 22 was read by Mr. F. M. Wilkes, of Poplar Bluff, and was entitled "A Trip Through a Small Plant." Beginning at the coal car and describing realistically a walk through his plant in company with the president of his organization, the speaker told how economies had been effected by cleaning all coal from the bottoms of cars, firing boilers properly, closing small steam leaks, cutting gaskets economically and effecting a general clean-up in the engine room.

In a paper on "High-Pressure Gas Distribution and Its Advantages," Mr. S. H. Wallace, of Webster Groves, told of the great development in the electrical industry due to high-tension transmission and centralization of power plants. The speaker firmly believed that the time will soon come when the gas industry will be handled in a similar manner.

Electric Signs

Reading a paper entitled "Electrical Advertising," Mr. F. T. Hopkins, of St. Louis, declared that the electric sign is the thermometer by which the town is judged. There is no such selling argument as a demonstration, and the use of electric signs by the central station should be encouraged to show the faith of the electric-service company in its own product.

Central-station men in small towns sometimes complain that the available sign load is so small that it would not pay to develop it, said Mr. F. A. Kehl, of St. Louis. Most of the profit, however, in such cases comes not from the sale of energy, and if these men would develop their sign business the profit on maintenance would surprise them. In addition to the profit, the value of the signs as an advertisement for electric service should be considered.

Speaking of the sign business in St. Joseph, Mr. J. A. Porter said that in the past year 12,500 10-cp lamps had been installed upon sign circuits, operating from dusk until 11 o'clock. In addition, said Mr. Porter, 165 good prospective sign customers have been secured, these becoming more numerous with each sign sale. Throughout the campaign of this company only high-class signs have been sold, as a poor sign never satisfies a purchaser. The St. Joseph company includes lamp renewals and flasher maintenance in its flat-rate schedule.

Mr. F. D. Beardslee, of St. Louis, said that the companies in small towns should get in touch with sign companies and establish a sign campaign with the help of the manufacturers. The chief way to attract attention at the beginning of a sign campaign, the speaker said, is by placing electric signs upon the company's office and generating station to show confidence in the advertising ability of such displays.

As an example of what can be accomplished in small towns, Mr. R. J. Irvine, of Trenton, stated that he had started a sign campaign a few months ago and now had enough signs connected to justify a separate sign circuit, 600 lamps being in operation and 4800 lamps in prospect.

Others who spoke in the discussion were Messrs. B. L. Elbert, of St. Joseph; W. S. Merkle, of St. Louis, and J. W. Van Brunt, of St. Joseph.

Co-operation with Public Service Commission

The session on Saturday morning (May 23) was opened by Mr. J. D. Bowles with a paper entitled "Opportunities for Co-operation between the Public Service Commission and the Missouri Public Utilities Association." The commission is about to issue rules governing voltage regulation, interruption records, records of time of starting and stopping generating systems, and records of output. The rules will also cover maximum allowable deposit as security and will probably require that service meters be furnished free by the utility companies. All utility operators will be informed of public hearings on these rules before their final adoption and promulgation. With the co-operation of the Missouri association and under the guidance of the N. E. L. A. report to be made at Philadelphia, the commission hopes that it will be able to establish suitable overhead distribution standards and specifications.

Employees' Welfare

Presenting a paper entitled "Employees' Welfare," Mr. Hermann Spoehrer, of St. Louis, told what the Union Electric Light & Power Company of St. Louis is doing to promote the welfare and happiness of its employees. Mr. Spoehrer sketched the organization of the Employees' Mutual Benefit Association and told of its financial standing, stating that during eighteen months' operation the company had extended ninety-four loans, aggregating $2,250, under this plan. The loss entailed during the eighteen months has been but $15. Mr. Spoehrer also spoke of the work of the safety

committee and outlined the bonus plan which the company contemplates placing in operation among employees not in the sales department of the company.

Following Mr. Spoehrer's paper, the report of the resolutions committee suggested that the committee co-operating with the Missouri Public Service Commission be continued and resolved that it was the sense of the association that setting aside of depreciation in a fund is impracticable.

Election of Officers

Following the report of the nominating committee, the secretary was instructed to cast a unanimous ballot for the following as officers for the ensuing year: President, Mr. A. C. Einstein, of St. Louis; first vice-president, Mr. G. E. Hayler, of Joplin; second vice-president, Mr. J. R. Woodfill, of Aurora; third vice-president, Mr. Hugo Wurdack, of St. Louis; secretary and treasurer, Mr. F. D. Beardslee, of St. Louis. The public affairs committee as elected consists of Mr. P. J. Kealy, of Kansas City, chairman, and Messrs. C. C. Barnard of Marshall, E. R. Locke of Mexico, L. D. Kelsey of Brookfield, Richard McCulloch of St. Louis, A. Harbut of Kansas City and S. E. Bronson of Ozark.

Mr. A. C. Einstein, the president-elect of the Missouri Public Utilities Association, is a native of St. Louis, graduating from the Manual Training School of Washington University in 1884. After a varied experience in engineering and mining work he organized a construction and engineering company in 1894 for the erection of electric and gas plants. Later he removed to Paducah, Ky., where he served as president and general manager of the electric light and street railway property until 1898. The following year he invented a number of acetylene-gas generators and became president of the Eagle Generator Company, serving in that capacity until 1907. In the meantime he had become associated with the Suburban Electric Light & Power Company in 1901, and in 1906 he purchased the King Electric Light Company. In December, 1911, Mr. Einstein was made president of the Union Electric Light & Power Company of St. Louis, and he still serves in that capacity.

Entertainment Features

With a cabaret troupe and an orchestra on board the steamer *Quincy* abundant entertainment was afforded the delegates and during the sessions card games and contests were provided for the ladies. Chafing-dishes and other electric appliances were given as prizes. At the banquet given the association by the Mississippi River Power Company at Keokuk addresses were made by Mayor H. W. Kiel of St. Louis, Mayor S. W. Moorhead of Keokuk, Messrs. J. A. Trawick of Keokuk, Richard McCulloch of St. Louis, J. W. Van Brunt of St. Joseph, J. D. Bowles of Jefferson City, C. R. Joy of Keokuk, A. C. Einstein of St. Louis, and Major Montgomery Meigs of Keokuk. Judge William Logan, of Keokuk, acted as toastmaster. One of the events was a visit to the cavern near Hannibal, Mo., described by Mark Twain in "Tom Sawyer."

Convention of Electrical Contractors in Indiana

Convening at the Claypool Hotel, Indianapolis, Ind., May 28 and 29, delegates to the Electrical Contractors' Association of Indiana took advantage of the opportunity to see the annual 500-mile automobile race held at that place on May 30. The morning session of May 28 was given over to the reports of the by-laws, membership and finance committees and to general business.

Eliminating Old-Code Wire

At the afternoon session Mr. J. E. Latta, Chicago, spoke on the "Underwriters' Attitude," telling of the work being undertaken to eliminate the use of old-code wire. The speaker also sketched the organization of the laboratories, stating that they are not run as a money-making business but charge only enough for tests to pay running expenses.

Mr. W. I. Stone, of the Indiana Inspection Bureau, said that the bureau knows what jobbers are selling old-code wire, and declared that he hoped to rid the State of this inferior product within the ensuing year. Others who took part in the discussion were Messrs. A. L. Swanson, D. Heimann, Jr., G. M. Sanborn and George W. Hill.

Co-operation Between Contractors, Jobbers and Central Stations

Mr. Egbert Douglas and Mr. C. C. Perry, Indianapolis, made several pertinent suggestions for closer co-operation between contractors and central stations. Both spoke highly of the co-operative selling scheme wherein the lighting company respects the rights of the contractor and dealer and refrains from selling electrical appliances at reduced prices. The jobbers' views on this subject were voiced by Mr. C. E. Roberts, Western Electric Company, Indianapolis, and Mr. H. A. Robertson, Electric Service Company, Evansville.

Better Wiring and Better Service

In a paper entitled "The Electrical Contractor and Lighting Service" Mr. M. D. Cooper, of the engineering department of the National Lamp Works, Cleveland, Ohio, presented a forceful argument for more adequate wiring. In the interest of better quality of lighting service, the speaker recommended that wherever possible installations of wiring should be designed to give a potential drop of not more than 1 volt. Data collected in the city of Cleveland in industrial, commercial and residential service show that the average drop is generally more than twice this limit. In closing, the speaker said that the stringency of competition in bidding on wiring in many cases may be due to the fact that architects do not fully realize the importance of careful attention to these matters. Consistent effort on the part of members of the association, said the speaker, should bring this subject forcibly to the attention of architects, thereby opening up an avenue for profitable business.

President Freeman's Suggestions

Mr. Ernest Freeman, president of the National Electrical Contractors' Association, read a paper containing several suggestions for making the work of the state associations more interesting and giving reasons why membership in contractors' associations is worth while. Among the principal things to be gained in meeting competing contractors are the acquaintanceships and the new ideas that are formed. Mr. Freeman attributes 80 per cent of the success of his organization to the help gained from national and state associations. Briefly, the remaining ideas included in the paper were: Build credit among Indiana contractors so that their reputation will stand as high as that of any other class of business men; get a state license law enacted; appoint a supply committee to confer with jobbers in regard to maintaining prices; attain a greater spirit of co-operation with central stations. Mr. Freeman also placed much emphasis on the desirability of the association's hiring a special representative. He said that if this man obtained a more equitable adjustment of rates on liability insurance enough money could be saved through his efforts more than to pay his salary.

Mr. George W. Hill, special representative of the National Contractors' Association, briefly explained the standard system of bookkeeping.

Definite Plans of the Society for Electrical Development

Stating that the Society for Electrical Development had now completed its working plans, Mr. H. H. Cudmore, Cleveland, read a short paper entitled "Why and How." The plans of the society, said he, although national in scope, will be local in action. The paper covered the general plans of the society as printed in the *Electrical World.*

Wider Scope for Jovians

In the absence of Mr. T. A. Wynne, Indianapolis, Mr. George L. Skillman, secretary of the association, read Mr. Wynne's paper on Jovianism, in which the writer said he favored wider membership in the society, including those who have financial interests in electrical public utilities. Pointing to the franchise and competitive situations existing in Toledo and Cleveland at the present, Mr. Wynne said that the efforts of the Jovian order should be directed toward the relief of utility companies in those towns.

Commenting upon the general interest shown by contractors installing high-efficiency tungsten lamps, Mr. H. H. Magdsick, Cleveland, told in what branches of business these units have been applied most successfully, pointing out their adaptability to projection work.

Too Much Estimating Leads to Failure

Speaking extemporaneously upon the pitfalls in estimating, Mr. G. M. Sanborn, Indianapolis, said that the general failing among contractors lay in estimating too often. The contractor who is financially successful, said he, selects with care the jobs upon which he bids, and having selected them makes a careful analysis of the work to be done. Having a list price of the material to be used and sufficient experience to tell him something of the cost of labor, the contractor should find no pitfalls in estimating.

At the close of the convention, Mr. G. E. Varney, of the Varney Electric Company, Indianapolis, stated that at present there are, strictly speaking, no jobbers in the electrical business. The men who are known as jobbers are really distributers or service men. Mr. Varney said that the so-called jobber should confine his operations to his own geographical territory, distributing through the contractor and not selling to the contractor's customer.

Officers for the Ensuing Year

Election of officers held at the second executive session resulted in the re-election of President M. K. Foxworthy, Indianapolis; Vice-president A. L. Swanson, Evansville; Secretary George L. Skillman, Indianapolis, and Treasurer F. L. Meier, Indianapolis.

First National Foreign Trade Convention

The first national foreign trade convention was held at the Hotel Raleigh, Washington, D. C., on May 27 and 28. Representatives of the large industries of the country were present to discuss methods of development of export trade and the effect of new laws on foreign commerce. The convention was held under the auspices of the American Manufacturers' Export Association, the Pan-American Society of the United States and the American Asiatic Association.

Mr. M. A. Oudin, manager of the foreign department of the General Electric Company, read a paper on "Government Assistance in Foreign Trade." In beginning he remarked that a trained observer of our foreign trade once said that the greatest need of the American manufacturer was to convince himself that what he really needed was a foreign market. Figured in dollars and cents our total exports are prodigious. Analyze these figures and it is found that the volume of exports of manufactured articles of complicated character is not altogether satisfactory. Mr. Oudin added that we are misled by the astonishing total of our exports and also by the classifications, in which manufactures of low form—products of the soil, mines and forest—on which comparatively little labor has been expended, are included.

England and Germany

The chief competitors of the United States, in the order of their importance, England and Germany, surpass the United States in the extent and variety of their exports, especially manufactured goods, Mr. Oudin declared. They should be considered as examples of what nations may do when the peculiar genius of their peoples is assisted by the most efficient use of their none too prolific resources and is backed by the powerful influence of government. The export business of these countries presents a most serious national problem. Both invest their surplus funds in foreign loans and foreign enterprises on the theory that "trade follows the loan." A forceful national policy has been adopted as a matter of course. These and other European countries consider that it is the first duty of a government to favor in every possible way the growth of commerce.

The progress of our foreign trade is beset with many difficulties in addition to those already mentioned. The lack of experience no doubt will be replaced in time by the knowledge of how to conduct that trade. An ultra-conservatism in the investment of surplus funds abroad may give place to the audacity characteristic of home enterprises, particularly if capital, naturally timid, can be made to feel that it will have the moral and physical support of government. Our immediate concern, said Mr. Oudin, is with the attitude of government toward those engaged in commerce with other countries. Unfortunately, government assistance and government co-operation in such matters have not yet become a part of our national policy. Until we are willing to adopt a policy with respect to the furtherance of our foreign trade at least as aggressive and stimulating as that followed by our commercial rivals we must not expect to equal them as international traders.

In the case of this country, Mr. Oudin continued, the new competitive conditions introduced by the latest tariff law have brought home more strongly than ever the need of acquiring an enlarged foreign market. The foreign offices, ambassadors and ministers of the great commercial nations are now chiefly occupied in playing the great game of international trade. This diplomatic activity seeks to obtain government contracts, concessions and participation in loans, to safeguard patent, commercial and other rights, and in countries of inferior civilization to prevent the repudiation of financial obligations and commercial contracts, or the passage of laws unfavorable to the extension of trade or similar acts.

Germany was cited by Mr. Oudin as presenting the best example of what close co-operation between government and trade may accomplish. The marvelous strides of its commerce at home and abroad have been quickened by the constant vigilance and well-directed efforts of its foreign office, the enactment of favorable legislation and the paternal attitude of the administra-

tive branches of the government. No international trade incident seems to be too insignificant for the attention of the Foreign Office. The regulation of trade in Germany is intended to free trade and permit it to follow natural and economic laws. But it is startling to learn that to enable exporters to meet competition the government will reduce freight tariffs on the state-owned railroad in special cases. By pressure or otherwise, steamships will give special rates and banks will grant unusual credits. What has been said of Germany applies to other European countries.

Continuing, Mr. Oudin said that the commercial activities of our own people find to-day their most hearty support in one of the executive departments of the government, namely, the Department of Commerce, a subdivision of which, the Bureau of Foreign and Domestic Commerce, deals with affairs in which manufacturers, producers and exporters are deeply concerned. Unfortunately, the desire and ability of the bureau to second the efforts of private enterprise are limited by the resources available. To place the bureau on a footing commensurate with the greater ideas of usefulness in the mind of the Secretary of Commerce, the latter has recommended an enlargement of its scope. The proposed plan provides for the appointment of a higher grade of officials than consuls, to be known as commercial attachés and connected with our embassies and legations, and for an increase in the number of commercial agents, who so far have operated with excellent results, and finally that consuls on purely commercial matters shall co-ordinate with the attachés and report to the Department of Commerce.

Most prominent on the list of exports first to be mentioned in any discussion of the subject, Mr. Oudin added, stand steel products, automobiles, agricultural implements, locomotives, electrical machinery, sewing machines, cash registers and other articles, all of which are produced and marketed by manufacturing companies of very large size. These concerns have accumulated a foreign experience derived from a foreign trade extending in most cases over many years and in many lands.

Friendly Intercourse and Commercial Treaties

There are many doors leading to the trade of oversea countries. Some of them are partly opened. Some of them are locked to all but those who have the key of experience, but the main door is that which is opened by friendly intercourse and commercial treaties and which is kept open by the co-operation of government. While other nations are crowding through the open doors which we as well as they have created care should be taken lest Americans be prevented from utilizing their hard-won advantages or be handicapped in freedom of action because of ill-considered government regulation.

Without in any way mitigating the law in its application to conditions within our own borders, and without in any way imperiling the interests of Americans competing with each other in foreign markets, something ought to be done to relieve the situation in respect to Americans selling American goods in foreign markets in competition with foreigners. Much of the proposed anti-trust legislation now pending in Congress threatens great harm to the export trade. Some of the provisions, if enacted into law, would practically make it impossible to continue to do business abroad.

The committee on judiciary of the House of Representatives has reported a bill containing strict prohibitions against discriminations in prices and agreements for exclusive agencies, but providing that such prohibitions shall apply only in respect to commodities sold within the jurisdiction of the United States. This emphatic recognition of the distinction between domestic commerce and export commerce reflects the growing disposition of the government to render sympathetic assistance to American exporters. Unfortunately, however, this distinction was not recognized when the Sherman law was passed, so that all prohibitions enacted in the Sherman law with a single eye to domestic commerce now fall with blighting effect upon our entire export commerce. Until this situation is squarely faced and the Sherman law is supplemented with legislation making it inapplicable to American commerce outside the borders of the United States, Americans will continue to be handicapped in selling American goods in foreign markets in competition with foreigners.

To Stimulate Foreign Trade

In order to increase co-operation between the legislative and executive branches of the government and to remove existing handicaps to foreign trade and commerce, Mr. Oudin said that the convention might properly urge that funds be appropriated to put the Department of Commerce on the footing of usefulness and importance advocated by the Secretary of Commerce, that the commercial efficiency of our foreign diplomatic and consular service be strengthened in the manner suggested by the Secretary of Commerce, and, finally, that provision be made to remove the handicap which the existing law places upon American capital and American enterprise now engaged in the American export trade and to permit Americans a free hand while selling American goods in the markets of the world.

In conclusion, Mr. Oudin said that it is proper, while earnestly advocating these steps, to remember that government assistance and regulation cannot create trade. They can only prepare the way for the private enterprise of our citizens, upon whom must fall the burden of fulfilling the promise held out by our resources, wealth and geographical position.

Addresses were also made by Messrs. James J. Hill, president of the Great Northern Railway; James A. Farrell, president of the United States Steel Corporation; John D. Ryan, president of the Amalgamated Copper Company; William C. Redfield, Secretary of Commerce, and many others.

Public Service Commission News

New York Commissions

Upon an opinion rendered by Commissioner Milo R. Maltbie, the Public Service Commission for the First District has ordered the New York Railways Company to restore to its reserve for injury and damage claims the sum of $33,984. In its last report for 1913 the company showed the transfer of this amount from the reserve account to the surplus account covering a prior period. The commission decided that while the company could fix the amount of the reserve, it had no right to transfer it to another account for a different period of time.

Mr. D. B. Murphy, of Buffalo, has been retained by the New York Public Service Commission, Second District, as its counsel in connection with its inquiry into the rates of the New York Telephone Company. Other duties prevented Mr. Ledyard P. Hale, the commission's regular counsel, from taking up the telephone work. At a meeting of representatives of the various bodies interested in the investigation, Mr. John L. Swayze, counsel for the telephone company, estimated it would take a year for 300 men to make a complete appraisal of the telephone property.

Massachusetts Commission

The public lighting committee of the Massachusetts Legislature has voted to report a bill codifying the laws relating to the manufacture and distribution of gas and electricity.

Among the amendments which have been suggested to the present law are provisions to bring the hydroelectric companies of the State under the supervision of the Board of Gas & Electric Light Commissioners; to allow electric companies with the consent of the commission to take land by eminent domain for transmission lines, and to give the board further powers of control over voluntary associations. The committee has also voted to report a bill to transfer from the Public Service Commission to the Gas Commission the supervision of telephone and telegraph companies.

Idaho Commission

Advices from Boise state that the cases involving the power of the Public Utilities Commission of Idaho to deny competing companies the right to do business in territory served by existing companies have reached the stage of presentation to the State Supreme Court. The cases are those in which the Great Shoshone & Twin Falls Water Power Company filed a complaint before the commission against the Idaho Power & Light Company and the Southern Idaho Power Company complained against the Beaver River Power Company. The companies against which complaints were made sought to enter districts already served by the other companies. The two companies which were brought before the commission on complaint declared that the commission was without authority to prevent them from constructing in the territories served by the other companies, and the cases went to hearing before the commission.

The commission decided that it was within its jurisdiction in investigating the complaints and held a number of hearings at which evidence was presented. The main contention of the companies already serving the territory was that they were in a position to supply consumers with electrical energy for years to come and were generating more energy than consumers could use, and that to permit competitive companies to enter the territory would only be wasteful competition and duplication of systems, which would be unfair to the investors who already had their money in the existing properties.

The attacking companies held that the rates of the existing companies were unreasonably high and unfair and that public necessity demanded competition, that there was a demand for more electrical energy and that the companies serving the field could not meet the demand.

The decisions of the commission were that wasteful competition and duplication would occur if the new companies were permitted to enter the territory and that this would be unfair to the existing corporations. The commission ordered reductions in rates of the existing companies and later promulgated a schedule of uniform rates for all of the large power companies in the southern Idaho territory. Since that time the commission has steadfastly upheld its policy of preventing wasteful competition, following the position taken by the State commissions generally.

In their petition to the Supreme Court the contesting companies asked that the findings of the commission be reviewed and alleged that they were unlawful. The companies declared that the existence of the commission is unlawful and in violation of the constitution of Idaho. Upon these grounds they asked that the orders of the commission be overruled.

Current News Notes

ASSESSMENT OF MISSOURI PUBLIC UTILITIES.—The Missouri State Board of Equalization convened at Jefferson City, Mo., on May 18 for the purpose of assessing public utilities of the State. Indications were that electric light companies would receive about the same valuation as in 1913 in most instances. The State Attorney-General, however, called attention of the board to the valuations of telephone companies and asked that they be raised.

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AVALANCHES ON ORDER.—By means of electric mines placed deep in the congealed névés mantling the crests of the Swiss Alps, avalanches are being manufactured to order for the benefit of moving-picture photographers and others who find the sport attractive enough to pay the prices charged. The mines are connected by cable with a magneto in the valley, and when all is ready a push of the control lever fulminates a large quantity of gunpowder up on the side of the mountain and down comes the artificial avalanche with all the terrifying rush and roar of a natural landslide.

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HUCKLEBERRY FINN'S ISLAND.—The Mississippi River region served with hydroelectric energy from the Keokuk water-power plant of the Mississippi River Power Company was long ago made famous by the writings of Mark Twain (Samuel L. Clemens), who lived at Hannibal, Mo., and as a boy took part in the juvenile adventures afterward recounted in the familiar stories of Tom Sawyer and Huckleberry Finn. Huckleberry Finn's island still remains in the Mississippi River near Hannibal, but is now the property of the power-transmission company and supports the mid-stream tower structure of the high-tension crossing at this point.

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INTERIOR ILLUMINATION IN LORD & TAYLOR'S STORE, NEW YORK.—In the May 23 issue of the *Electrical World* the interior lighting installation of the Lord & Taylor department store, New York, was described as consisting of semi-indirect lighting fixtures having a "bowl within a bowl." To be more accurate the article should have read: "The semi-indirect bowls used on the two lower floors are made of cased glass, the inner layer being a special shade of blue glass which modifies the light of the tungsten lamps so as to produce approximately subdued daylight." Because of this color correction fabrics will retain their approximate daylight color values when examined under the light. Dark navy blue can even be distinguished from black in this light.

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ELECTRIC DRIVE IN THE WORLD'S LARGEST COAL MINE.—In the Nokomis (Ill.) mine of the Peabody Coal Company, which is said to be the largest coal mine in the world and which is operated entirely by electrical energy, the electricity is purchased from the Central Illinois Public Service Company, being transmitted 28 miles at 33,000 volts from the generating station at Kincaid. Transformers and motor-generators change this energy into direct current for operating the main mine-hoist motor, which is rated at 1500 hp and is operated at 550 volts. Thirty electric coal-mining machines are used, and also ten 5-ton electric locomotives and two 15-ton main haulage locomotives. The main ventilating fan is driven by a 150-hp, 440-volt induction motor, and all auxiliary equipment throughout the mines is electrically driven. The Nokomis mine, when working at full capacity, is capable of an output of 8000 tons a day.

SOCIETY MEETINGS

Meeting of Minnesota Electrical Contractors.—The fifteenth annual meeting of the Minnesota Electrical Contractors' Association will be held at the Builders' Exchange, St. Paul, Minn., on June 22, 1914. The morning session will be called to order at 9:30 o'clock. Mr. G. M. Jones, of the Minneapolis Electric & Construction Company, is secretary of the association.

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Chicago Illuminating Engineers to Discuss Electric Signs.—A joint meeting of the Illuminating Engineering Society and the Western Society of Engineers will be held in Chicago on June 10. A paper on the design of electric signs will be presented by Prof. A. H. Ford, Iowa City, Ia., and Mr. P. E. Haynes, of the city electrical department, will present a paper on street and subway plans.

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American Institute of Consulting Engineers.—A meeting of the American Institute of Consulting Engineers will be held at the City Club, New York City, June 11. The special order of business will be the question of a memorial to Alfred Noble, and the proposed changes in the constitution, and by-laws recommended by the special committee appointed at the last annual meeting will be considered.

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Meeting of Cincinnati Jovians.—A banquet at the Sinton Hotel and the initiation of fifty-three new members featured the recent rejuvenation held by the Cincinnati Jovians on May 18. The membership has now reached over 200 as the result of the general enthusiasm among the electrical men in the city. Informal talks were made at the banquet by Mr. J. A. Brett, sales manager of the Cincinnati offices of the Westinghouse Electric & Manufacturing Company, who declared that all branches of the electrical trade should stand behind public service corporations as against unjust legislation, and Mr. T. J. Ryan, of the General Electric Company, Mr. W. W. Freeman, vice-president of the Union Gas & Electric Company, also addressing the gathering.

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Institute of Radio Engineers.—At a meeting of the Institute of Radio Engineers held at Columbia University on May 13 two papers were read and discussed at length. Dr. John Stone Stone presented a study of oscillations in circuits containing spark-gaps and those coupled thereto whereby computation is much simplified by the use of linear decrements. Mr. Emil J. Simon then described some recent work on three-phase radiotelegraph quenching-gap transmitters, and demonstrated the actions to be observed in such apparatus by the use of three 0.5-kw sets operated in rotation from a three-phase generator. Circuit interactions and irregularities could be noted with ease by means of the rotating vacuum tubes and loud-speaking telephones which were used in the demonstration experiments.

* * *

Change in Method of Judging Students at Technical Schools.—Speaking before the Chicago Jovian League on May 25, Mr. Fred R. Jenkins, secretary of the Chicago Central Station Institute, stated that there are now over 200 corporations which are maintaining schools for the education of their employees and prospective employees. One of these concerns is spending over $50,000 a year in this work and maintains that were the price three times what it now is the work would not be discontinued. Most of the men entering these schools are selected from the technical schools of the country, and the professors of these universities, realizing that men for these positions must have some requirements besides high standing in scholarship, are changing their methods for judging men. Among the leaders in this movement, said Mr. Jenkins, is Prof. C. F. Harding, of Purdue University, who requests all instructors in electrical engineering to judge the men on mental caliber, speed, interest, reliability, honesty and popularity. Later the men are again judged by committees of their classmates, and it is of interest to note that men are generally rated lower by their classmates than by the instructors. Mr. Thomas A. Grier, of Chicago, and Mr. W. W. Winship, Jovian statesman-at-large, of Philadelphia, also spoke.

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Annual Convention Oregon Electrical Contractors' Association.—The second annual convention of the Oregon Electrical Contractors' Association will be held on June 8 and 9 at Pittock Block, Portland, Ore. The program comprises an address of welcome and a response by Mr. R. G. Littler, president of the Oregon Electrical Contractors' Association. An address will also be given on fire causes and prevention, with stereopticon views, by Mr. E. M. Underwood, of the Failing-McCalman Company, and the following papers will be read: "Electrical Contractors' Association," by Ernest Freeman, president of the National Electrical Contractors' Association; "Electrical Jobbers," by Mr. Ross Hartley, manager Pacific States Electric Company; "The Society for Electrical Development," by Mr. J. M. Wakeman, manager of the society. A business session open to members only will be held on the afternoon of June 8. This will be followed by a trolley ride to Council Crest. In the evening a trolley ride to "The Oaks" is scheduled. On June 9 a tour of inspection will be made of the power plants of the Northwestern Electric Company and of the Portland Railway, Light & Power Company. On the afternoon of June 9 the delegates will be taken in automobiles to the baseball game of the Pacific Coast League. The convention will close with a banquet and entertainment at the Portland Hotel on the evening of June 9.

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New York Electrical Society.—The following have been nominated for officers of the New York Electrical Society for 1914-15: Mr. Frederick A. Scheffler, president; Messrs. O. A. Kenyon, Bernard Rowntree and George Weiderman, Sr., vice-presidents; Mr. George H. Guy, secretary; Mr. James H. McGraw, honorary treasurer, and Mr. Henry J. Hoeltge, treasurer. On May 25 Dr. L. A. Bauer, director of the department of terrestrial magnetism of the Carnegie Institution, Washington, delivered a lecture before the Society at Columbia University on the work and cruises of the nonmagnetic yacht *Carnegie*. This vessel has covered more than 100,000 route miles. She will leave early in June for a cruise in the North Atlantic Ocean toward Norway and Iceland, returning to Brooklyn at the end of the present year. During the two years 1915 and 1916 she will be cruising in the South Pacific and South Atlantic Oceans between the parallels 50 deg. S. and 70 deg. S. Thus within the next three years it will be possible to issue new magnetic charts for the greater part of the globe. After Dr. Bauer's lecture Lieut. John Cyril Porte, who will be the pilot of the Rodman Wanamaker transatlantic flier, addressed the society on "Aerial Navigation." Much care has been expended on the work of preparation and every scientific resource now available is to be utilized in this enterprise. The annual meeting of the society will be held on June 10, at which time Mr. William P. Kennedy will deliver a lecture on "The Electric Vehicle in New York City," illustrated with motion pictures, relating to the simplicity, economy and other features of the vehicle.

N. E. L. A. Convention Papers and Discussions

Abstracts of reports and papers read at the thirty-seventh annual convention, held at the Bellevue-Stratford, Philadelphia, from June 1 to June 5, 1914

ON preceding pages are reported those features of the thirty-seventh annual convention of the National Electric Light Association held at the Bellevue-Stratford Hotel, Philadelphia, Pa., June 1 to 5, which are of particular interest from the point of view of their news value. Herewith and on the pages following are given abstracts of the papers and committee reports presented during the convention, together with accounts of the discussions occurring during the various sessions. It will be noted that these abstracts and their discussions are arranged under general topics, without respect to the order of their presentation in the sessions or to the section of the convention before which they were discussed.

RELATIONS WITH THE PUBLIC

Public Policy Committee Report

Looking back over the reports of previous years, the committee on public policy stated that it found no reason to retract or modify any of the recommendations of the past. Rather has time proved that they indicate a wise, constructive course which may well be followed to the benefit of the members individually and the industry collectively. The committee made note of an evident and spreading effort throughout the industry to maintain the highest attainable standards of service, to safeguard the health and lives of employees and to conduct affairs generally in a manner to commend the industry to the public at large. The report was signed by the following members of the committee: Messrs. Nicholas F. Brady, Everett W. Burdett, Henry L. Doherty, Charles L. Edgar, W. W. Freeman, George H. Harries, Samuel Insull, John W. Lieb, Joseph B. McCall, ex officio, Thomas E. Murray, Samuel Scovil, Charles A. Stone, Herbert A. Wagner, and Arthur Williams as chairman.

The committee found little conflict between its own views and those generally recorded by the various public service commissions. It has held consistently that the business of supplying electrical energy from large central stations is essentially a monopoly in the best meaning of the word. If a monopoly and privately owned and operated, but occupying public property to render a public service, it must be regulated by some public authority. Monopoly in public service can be justified only on the ground that some advantages accrue to the public. This position with the public cannot be maintained unless it can be shown that the greater part of the benefit resulting from such monopoly goes to the public and not to stockholders of the corporation.

The committee quoted from a recent decision of the Railroad Commission of California in the San José telephone case which says in part: "Life is entirely too short to be utilized in trying to make natural monopolies do what they say they can and ought to do without competition." The committee believes that the newer commissions are approaching their duties in a broad spirit of fairness and notes the reaffirmation of the newer as well as the older commissions of the general principle of non-competition in the field of regulated public utility enterprises.

In taking up "fair rates and good service" the committee says that usually, but not always, criticism begins with rates. All rate schedules should have the widest publicity. They should never be discriminatory in their nature and they should be fairly representative of the cost of rendering the various classes of service to which they pertain. The committee stated that there are certain localities within which, while the rates have been reasonable, serious dissatisfaction has arisen because of the unsatisfactory nature of the service, or indifference or ignorance on the part of employees of the company. Reasonable, simple public rate schedules, an efficient, well-trained organization covering every feature of the activities of the company and a service of the highest standards, made available through the lastest and most improved types of incandescent lamps and other apparatus, are service features to which every community is justly entitled. If members fail in giving these, they fail in performing their just obligations to the public and to their own stockholders.

One of the purposes in maintaining a regulated monopoly in the electrical industry is to secure to the public and to the corporation the inherent advantages of generating and distributing electrical energy on a large scale to widely diverse classes and conditions of service. The larger the scale and the wider the diversity the greater the obtainable economies. Members are urged to endeavor to combine all of the electric service of the respective communities. The resultant benefits will be shared not only within the industry but with the public to the largest practicable extent.

In speaking of industrial education the committee says that throughout all of the undertakings of the membership special and general training from the elementary to the highest stages should be a continuing effort. The committee believes that, wherever practicable, the so-called continuation schools covering the various activities of the industry should be conducted by the members, that attendance should be within the employers' and not the employees' time, and that the courses should be broad and general as well as specific and individual, so as to be most productive of the highest degree of human efficiency.

Regarding safety and sanitation the committee says that attention should be directed first to the elimination of all possible danger spots in the plants and distributing systems and second to the training of the employees and members to be constantly alert for danger to themselves and their fellow-workers. One of the member companies found that during the last seven years only 7.7 per cent of its accidents occurred as the result of negligence on its own part. The other 92.3 per cent occurred through carelessness and negligence on the part of the person injured or on the part of a fellow employee or an outside contractor. The average number of fatalities per 1000 employees among central stations of the Second District of the State of New

York for the three years 1910 to 1912, inclusive, was 4.67, while for the central stations of the First District, which includes most of the larger central stations of the State, the corresponding figure for the years 1909 to 1911, inclusive, was 1.93. The largest central station in the latter group averaged less than one fatality per year per 1000 employees in the last seven years. This would tend to show that the accident-preventive measures which the largest companies have been particularly active in adopting have borne fruit. Several members have well-organized safety departments. One has recently adopted the rule that 10 per cent of its employees shall be appointed to membership upon safety committees for a period of six months. At the expiration of this period another 10 per cent is appointed to these committees and so on, until within a period of five years all of the employees will have served on the safety committees. This plan is commended to members.

The section of the report dealing with hydroelectric development expresses gratification that the Legislature of New York State declined this year to pass the proposed measures under which the State would have developed its water-powers and entered into competition with electric utilities. The committee says that the defeat of these unjust and destructive measures would indicate that matters of this kind, involving questions of good faith and the wise conduct of public affairs, may be safely left to the people and in general to their law-making representatives. The committee indorses most of the recommendations which were unanimously adopted by the committee on water-powers of the Fifth National Conservation Congress.

Concerning public ownership and operation the report says that perhaps the most serious and unfair instance culminating during the year is that of the municipal electric-light plant in Cleveland. The committee claimed that the membership will recognize that if the price of 3 cents per kw-hr. prevails a very large percentage of the service will be supplied at a serious loss. In the judgment of the committee, with fair public regulation municipal ownership is bound to fail. Approximately 235 plants have been abandoned—in some instances only the plants, and in others both plants and distributing systems. The committee remarked that various municipalities in England are beginning to awaken to the serious burdens imposed by the ownership and operation of public utilities and that signs abound of a general reaction against this policy. Attention was called to the recent book by Yves Guyot on "Where and Why Public Ownership Has Failed," which was translated into English through the efforts of the committee. The committee has also encouraged the organization of the Bureau of Public Service Economics, New York. This bureau is prepared to make reports upon any government or municipal undertaking in this country or Europe on very short notice. The committee adds that it will be appreciated that there is no thought of concealment of the moral support behind the bureau. What little financial support it has needed has been available through its activities and the sale of various publications. The committee feels that with a straightforward statement of the purpose of the bureau this latter point is of incidental importance, as enlightened public opinion would hardly fail to support even material contributions to a purpose which simply sought to inform the public and place the industry before it in a proper light.

One phase of employee relationship highly commends itself to the members of the committee. This is the provision of convenient means to accumulate savings whereby employees of the industry are aided in the purchase of their homes and of the securities of the companies by which they are employed. One of the members whose stock is not upon the market has assisted its employees in organizing a security-holding corporation, the shares of which are purchased upon the instalment plan. The securities behind the shares are the securities of the local electric light and gas companies. The committee commends to members any methods by which their employees are encouraged in the acquirement of either the homes in which they live or the established securities of the corporation by which they are employed.

There are three appendices to the report. A number of decisions were reviewed by Messrs. Beardsley, Hemmens & Taylor, counsel of the New York Edison Company. In these attention was called to the recognition by commissions of the monopoly character of public service companies, the provision of supplementary service to block-lighting plants and the inclusion of business-building expenditures and going values in appraisals. Another well-established principle which has been reiterated by the courts during the last year, and which to a certain extent affects the large wholesale business of electric-supply companies, is that relating to the resale of merchandise. These decisions are of considerable importance to electric companies in cases where energy is sold in bulk to a customer who may dispose of it as he sees fit. Another appendix contains the unanimous recommendations of the committee on water-power of the Fifth National Conservation Congress. The last appendix contains an article on "Three-Cent Light In Cleveland," written by Mr. H. W. Wilson for the Bureau of Public Service Economics.

Rate Research

The rate research committee, of which Mr. E. W. Lloyd is chairman, presented a brief report accompanied by an appendix on the value of the service theory in rate making, and a set of rules to govern the form and construction of electric rate schedules.

Early in the year the committee discussed at some length the tendency of the public service commissions to require complete valuation of electric-light properties as a basis for rate-making. This is a natural tendency on the part of the commissions, owing to the facts that it is necessary for them to base their conclusions upon actual figures, and that the usual methods used by the companies in making rate adjustments from time to time are not considered by the commissions as substantial enough to form a basis for a final conclusion as to rates, when such conclusion might be reviewed by the courts. It is an interesting fact, however, that some of the commissions have not required valuation for rate-making purposes and have considered that it is practicable to make rate reductions based upon the annual reports and general condition of the company under consideration.

Even the commissions that base their rate determinations upon valuations are forced, when they come to the actual determination of the individual rate, to depart from the mathematical exactness that a detailed valuation implies, and the great amount of labor and expense in determining the valuation and fair rate of return can be used only in determining the amount of net revenue which the company is entitled to receive for its corporate purposes.

In fixing the individual rates for each class of service the commissions are forced, on the one hand, to consider that maximum rates cannot be based upon an actual cost theory, but must be governed largely by policy and by precedent, and in fixing the wholesale rates the commissions have in general recognized that a central station must be free to meet the competition of the private plant. In the latter case they depart

entirely from the cost-of-service theory and adopt a value-of-service theory, but in general they have not recognized the great importance of the value-of-service theory in the actual formation of electric-lighting rates.

Rate Schedules

The committee, in completion of its work of the last two years upon the method and form for the filing of electric rate schedules, has also prepared a general set of rules for such schedules.

The committee believes that this is an opportune time to bring out a standard uniform form for the construction of electric rate schedules. While uniformity might be acquired through the co-operative effort of the various commissions, the committee believes, as was the case with rules for uniform accounting, that the N. E. L. A. is the best medium through which uniformity can be speedily attained.

The rate research committee, through the N. E. L. A., invites the co-operation not only of the member companies, but also of the state commissions in the general adoption of this "form and construction of electric rate schedules."

Appendix—Basis of Rates

The committee believes that there are two fundamental principles:

First—The rates should, as a whole, produce an income sufficient to give a fair return on the investment and attract capital freely to the enterprise. The gross earnings from the sale of the product must, therefore, be sufficient to cover all the necessary expenses of operation, including taxes, bad debts, etc., a reserve for renewals and contingencies, interest at current rates, and a reasonable profit in addition.

Second—When the rates as a whole are giving a fair return on the investment as above provided for, then the rates to separate individuals and classes which go to make up the rates as a whole should be so adjusted as to make the total cost as low as possible, and the service rendered as great as possible, by means of the most effective utilization of the plant.

The committee has further come to the conclusion that these results can best be obtained by adjusting the various rates to the value of the service rendered, giving proper consideration also to the relative costs of service, and defining value of the service rendered as the amount which the user would have to pay for the same or equivalent service under absolutely fair but not destructive competition; in other words, the amount at which the user could serve himself or provide an equivalent or substitute means of service under free but not destructive competition.

Disposition of the Profit to the Seller

When the profits to the seller are increased so as to be excessive and to exceed a fair return, whether by such a reduction as described or by any reduction in the sellers' total costs, then the original seller should reduce the rates or a new seller is likely to come in and do business at lower rates.

It is the province of commissions that regulate the prices of monopolies to regulate prices along these lines so that the public may obtain substantially the same prices as it would obtain under fair competition and provide that the public and the seller jointly may share in the savings that come from the avoidance of any unnecessary duplication of plant.

However, unless some of the profits are given to the seller, there will be no incentive to him to plan for a reduction of any sort, and this profit for the seller above an ordinary return is only his fair return for the extra skill in management, initiative, risk or energy that makes the reduction possible.

Competition of other methods with certain classes only would naturally affect only those classes and those rates. Competition (actual or potential) of the same methods by a similar seller affects all classes momentarily, but later affects only some. The competition referred to is the kind of competition that is fair and permanent, and not merely temporary or destructive. Destructive competition that merely reduces prices temporarily is not what the committee considered. Such competition does not permanently reduce prices; on the contrary, it will ultimately raise them.

Exceptions to the Rule

The committee notes some exceptions to the general rule that rates depend only on values. If there is a monopoly, the prices need not necessarily be reduced, but the seller may receive some or all of the extra profit within reasonable limits. Further, if the monopoly is controlled, the controlling authority may take the extra profit in the form of a tax or free service for itself or may decide who shall get the profit, as by requiring that free service be given to schools or at some arbitrary price to some particular class. Adjustments of prices to particular classes are sometimes made by controlling authorities for so-called sociological reasons. It should, however, be noted that attempts to solve sociological problems by means of low public utility rates are usually inefficient. These considerations have to do with the economic aspect of such special rates rather than the question of their expediency as a matter of public policy, which, in general, the committee considers outside the province of this presentation.

In ordinary business the seller sometimes attempts to whet his customer's appetite by making a low rate for a short time, or a landlord might make low rates in order to fill up his building, with the expectation of raising rents later, but such procedure is not usually considered proper for a public utility, unless it is very clearly announced that such low rates are merely temporary and are likely to be raised.

The public utility is expected to make its rates such that no permanent business shall be built up except on rates that are reasonably certain to be permanent.

How to Determine the Values

The simplest method is, of course, for the seller to use his judgment as to the value of the service rendered in any particular case; but whenever there are numerous values to be determined, especially if they are to be determined beforehand, this method becomes impracticable, and some test or method of differentiation must be adopted. Things that are physically the same may have different values at different seasons, as ice and fruit. The supply of electricity in summer, as compared with winter, is of this class, and so is the business supplied on any so-called "off-peak" rate.

Things that are physically the same have different values at different places. Coal is of different value at the mine and at the pit, and electricity is of more value in the city than at the waterfall.

Difference in value according to time is limited by cost of storage, and difference in value according to place by cost of transportation.

The tests of value by use are very prominent in the government postal service. The rates for post cards, circulars, sealed letters, etc., are all tests of value, according to use. In electricity the power rate, as distinguished from the lighting rate, is a test of value according to use.

Justifiable Differences

In both the straight meter rate and ordinary flat rates of so much per lamp per month there is a physical dif-

ference to both the seller and the buyer so that these rates are justifiable on the value theory.

In considering wholesale discounts as applied to meter rates or rates per lamp per month the committee assumed two cases, although they are sometimes expressed in one schedule: (1) transactions of different size, and (2) several transactions of similar size added together.

There is a complication in electric service that arises from the fact that the cost of breaking up wholesale delivery into retail lots differs very greatly in different places. In the case of the sparsely settled town, the wholesale supply is delivered at some point in the town, as at a substation, and the cost of breaking this up and delivering to the different houses is very high.

On the other hand, a wholesale supply to a big office building might have the same value just outside of the substation as in the case of the sparsely settled town, but in the case of the office building the supply can be broken up and delivered to the tenants at a relatively small expense as compared with the same quantity distributed throughout a small town.

The general conclusion is that wholesale and retail rates are fully justified whenever it is a question of the delivery of different amounts or under different conditions. When each point of delivery is considered by itself, the difference between wholesale and retail costs for delivery of large or small quantities may be very large.

On the other hand, the adding together of several small deliveries at different points in order to make a total for a wholesale discount does not justify as large a differential as when it is a case of different-sized deliveries at single points, although even in the case of several small deliveries added together a certain differential is justifiable on account of the difference in cost or value to the seller by billing, selling, advertising, bad debts, etc., and there is a difference in the value to the buyer for exactly the same reasons.

Minimum Rate

The committee then considers the minimum rate. The service would cost the supplying company about the same per customer and be about the same value to the seller, while such a service would be about the same value to the buyer, whether he used 1 kw-hr or 5 kw-hr. It follows that a minimum charge of some sort is indicated also by the principle of values, although, on the other hand, the psychological advertising worth of making no minimum charge may be of sufficient importance to warrant its omission.

Power

In spite of the numerous definitions of power, this can perhaps best be expressed in general terms as "non-lighting service."

The difference in value as between power service and lighting service, is, so far as the buyer is concerned, a difference of use. There are well-established and generally approved differential rates for charging storage batteries, for cooking, heating, ice-making, etc., in some cases combined and in some cases a separate rate for each class. In all of these cases the difference in value to the buyer is clearly a difference in value according to the use alone, and though the use itself may not affect the value to the seller, yet if there is a difference in cost and value to the seller, when the kind of use specified will produce a better load-factor at the station or greater total output, the difference in rate in these cases is fully justified.

In such rates as off-peak rates, the test is of difference of value to seller, and unless this happens to coincide with a difference of value to buyer they are undesirable.

Long-Hour Use and Demand

It is clear that the size of demand of large customers is a proper factor that may be taken into account in making the rate.

Which demand should be used—as to whether momentary, one-minute, five-minute, half-hour, etc., should be used, whether one demand or several averages, and as to whether a monthly or yearly demand should be used—is something on which companies have clearly no agreement.

Any of them, however, are to some extent a measure of what the buyer would have to invest in a plant and none of them is a perfect test that would apply to all cases.

On the whole, however, it would appear as though yearly demand would be a better criterion of what it would cost the buyer to run his own plant than the monthly demand whenever the ratio between the monthly and yearly demands was different with different customers.

In some cases the connected load is made a factor in the rate. It is, however, clear, that the connected load by itself is, for large customers, no test of the value of the service either of the buyer or the seller; but, on the other hand, it is true that the connected load is to some extent a measure of the demand, and to this extent its use in rate-making may be justified.

Street Lighting

In street lighting the value of service to the buyer is clearly quite different from the value of the same amount of service for ordinary commercial use.

The value to the seller is likewise quite different in the cases where special street mains have to be put in, etc. Where the street service, however, is taken off the regular commercial mains, the value to the seller is the same except so far as affected by the question of total output and as affected by the different service supplied, in the form of different lamps, the cost of turning on and off the lamps, etc., and by the load-factor produced at the station.

When in street lighting all-night service is compared with the moonlight, midnight service in certain towns, there is clearly a difference in value both to the seller and buyer which results in a difference of price, so that the price as between all-night and midnight lighting would never be the same per lamp or the same per lamp-hour, but would be a combination of the two.

In street lighting the value of the service to the buyer will be quite different for large and small lamps. For small lamps the value would be affected by the competition of gas and gasoline. For large lamps the value of the service to the buyer would be affected by the cost of policing where large lamps are not used. The value and cost of the service to the seller would likewise be quite different as between large and small lamps.

Attitude of the Company

In adjusting its rates, a company should frankly say that it must consider the availability of competitive facilities, actual or potential, and that no electric company can ever get more for its service than its competitors ask for equivalent service—its competitors being gas companies, isolated plants, oil companies, natural ice dealers, and all other means of producing service equivalent to that which the electric company supplies.

The electric company should further say that it is not entitled to any more than a fair return on its investment, and that its rates must not be more than it would charge under free but not destructive competition.

The company should then frankly point out that so

long as this is true it is not over-charging; and that so long as it gets all it can from its low-rate business, and gets enough in all cases so as at least to cover its additional expense in supplying such service, such low rates never harm, but in the long run benefit the rest of the business and the general public.

And finally, when any new rate is put forward which will develop business that could not otherwise be obtained, such rate, so long as it shows some profit over the added cost, is justifiable and the classes whose business was obtained without the rate have no claim to it, though later they may claim part of some general reduction due to any increased profits that may result.

When extra profits, thus or otherwise obtained, above a fair return warrant a general reduction in rates, no particular class is entitled to such reductions, but they should be made so as to be of most good to the business as a whole, by reaching down into new fields so as to be of most advantage to all the customers.

The appendix is signed by the following members of the committee: Messrs. E. W. Lloyd, chairman; L. H. Conklin, A. A. Dion, R. S. Hale, W. H. Johnson, J. W. Lieb, Jr., W. J. Norton, F. W. Smith, W. H. Winslow and Mike S. Hart, secretary.

What Users Can Afford

Mr. R. A. Philip agrees with the conclusion of the committee that the various rates should be adjusted to the value of the service rendered, giving proper consideration also to the relative cost of service. However, he thinks that of the two definitions of "value of service" given by the committee, first, "the amount which the user would have to pay for the same or equivalent service under absolutely fair but not destructive competition," second, "what each class can afford to pay rather than get along without the service," the second is the better. Mr. Philip says that while competition is the principal factor in determining some rates, there are many cases where the competition is not sufficiently definite to be used as a basis for rate-making, and in such cases a rate somewhere between the limits of what a buyer will pay rather than go without the service, on the one hand, and what the seller can take without incurring a loss, on the other hand, must be chosen by considering additional factors.

Discussion

In opening the discussion on the rate research committee's report, Mr. W. J. Norton, Chicago, one of its members, urged the importance of having rate schedules filed in a uniform manner, declaring that from the standpoint of the public the availability of rate schedules thus filed would be almost as desirable as uniform rates themselves.

Mr. H. Barker, New York, said that central-station tariffs heretofore presented have generally shown an intermingling of cost-of-service theory with a value-of-service basis, although the modern tendency is now toward the adoption of the cost-of-service plan, except where the necessary data are lacking, when recourse must be had to the principle of service value. It is, of course, difficult for state commissions to know intimately local conditions and values. Mr. Barker urged that utility companies seek public approval on the basis of a cost-of-service schedule, distributing their various items of investment cost, maintenance cost and operating cost under the appropriate heads of service to customers, including allowances for contingencies. "Apparently," said the speaker in conclusion, "even when trying to apply the principle of value-of-service as a fundamental process it is after all difficult for rate-makers to get far away from the cost-of-service basis."

A communication from Mr. Arthur S. Knight, Boston, was read by Mr. R. S. Hale, of that city. In his comment Mr. Knight pointed out that the report of the committee will require careful reading to avoid being misunderstood. He interpreted the report to imply that the rate which the buyer is willing to pay for service represents the value of the service to the customer, although such a condition may not be the most favorable for either the company or the public. Lower rates, for example, may operate to increase the volume of business, thus later indirectly benefiting the customer through the reduction of operating costs. If the value to the buyer is to be taken as a basis for rate-making, the whole question of fixing schedules may be taken out of the hands of the companies, said Mr. Knight, since the commissions will feel themselves quite competent to make such estimates of "value to the customer."

Mr. Hale said that certain items which are affected only by the costs to serve a single class of customers should be borne by that class whether incurred as investment or operating costs. Many expenses are, however, of a joint nature, as in the case where two or more classes of customers utilize the same investment. Assuming that a given return is to be earned on such investment, the percentage required should be divided between the customers in proportion to the relative values of the service to each. Such solutions must, of course, be worked out in the light of experience, but in general it will be the aim of the central station to have a given investment used by as many customers as possible, thus rendering small the cost to each, while making up the total return from a number of sources.

Mr. Henry Harris, Pittsburgh, asked whether the principle of value-of-service has yet been recognized by any commission. He suggested that commissions might not accept such a view unless it could be shown that the result would in return redound to the benefit of other customers. Even then, he further intimated, the commissions might demand the utility to justify its own confidence in its claims by arranging an immediate general revision of rates to the other customers thus affected.

Mr. J. C. Parker, Rochester, N. Y., declared that the cost of service and the value of service must always be correlated in the fixing of prices, and he suggested that the committee had been unfortunate in laying too much stress on the subject of value of service. In its anxiety to get business the central station is likely to overlook cost and to approach the limit where the expense of commercial effort plus the cost of rendering the service will make the business undesirable. Any schedule of rates, he declared, must come back to "the acid test of cost of service," if the transaction is to be economically sound. This is essential from the standpoint of the utility itself no less than from the view of the impression to be created on the public.

Mr. E. F. McCabe, Titusville, Pa., propounded a hypothetical question in which two manufacturers having identical requirements were to be served with central-station energy, the installation in one case replacing an isolated plant while in the other it was without previous competition.

Mr. Emil Dellplain, Syracuse, N. Y., declared that it will be hard to convince public service commissions that the principle of "value of service" differs from that of "what the traffic will bear." He conceded that the cost of service is extremely difficult to ascertain since it changes at least twelve, or even 365, times a year. If the new element of "value of service" is to be presented before the commissions with an honest purpose and open mind, Mr. Dellplain declared, he would give it his approval, but he thought it would be difficult to convince the commissions of the justice of the plan.

Mr. L. H. Scherck, Poughkeepsie, N. Y., commented on the lack of street-lighting information in the committee's report. The subject, he declared, is one that should not be neglected, although it is generally "fought shy of." According to the usual plan of fixing street-lighting costs the local city council simply compares the schedule of neighboring cities of like size, although these are themselves often far below cost, owing to ignorance. Mr. Scherck urged that the industry educate itself on street-lighting costs, a subject which, he thought, has been neglected heretofore.

In closing the discussion Mr. E. W. Lloyd said that the principle of "value of service" in rate-making has already been indorsed by the Massachusetts and Wisconsin commissions, while this theory has also entered largely into opinions rendered by other commissions and regulative bodies.

GENERATION AND TRANSFORMATION

Electrical Apparatus

The committee on electrical apparatus, having Mr. L. L. Elden as chairman, presented an eighty-two-page report on the design of recent types of generating and converting apparatus, air-cooling devices, switchboard equipment and protective devices. The design of outdoor and indoor stations, and the elimination of personal and fire hazards in electrical systems were discussed. Important advances in the developments of temperature-measuring devices suitable for use in connection with electrical apparatus were also mentioned. Details of standardization work in general, including the N. E. L. A. participation in the revision of the A. I. E. E. standardization rules, were treated at some length in the report.

Temperature in Electrical Apparatus

A brief method of calculating heat flow in electrical apparatus was outlined in Mr. F. D. Newbury's paper on "Temperature and Its Effect on the Power Capacity of Electrical Apparatus." The author indicated the difficulty of obtaining consistent thermometer indications and explained the wide variations often obtained. The significance of temperature measurement by mercury thermometer, resistance of windings and by thermocouples was shown.

While low temperature has become a criterion of excellence in electrical apparatus, the operating surface temperature is of importance only in its relation to the maximum temperature to which the insulating material can be subjected safely and continuously. Designing engineers are looking forward to the time when surface temperatures can be entirely neglected and sole dependence placed on internal temperature measurements made at the hottest parts.

In most generators very little heat flows through the insulation between coils as they are usually at about the same temperature. A somewhat larger flow occurs between the lower coil and the core, and a still larger flow takes place from the top coil to the slot wedge. Curves were shown indicating the temperature gradient transverse to conductors and along them. The highest temperature may be expected between separate coils or between the bottom coil and the core, as is borne out by actual tests.

Actual measurements in generators showed that temperatures ranging from 100 deg. to 130 deg. C. are not uncommon at the hottest parts.

A point of practical importance brought out by the diagrams and test results is the futility of measuring surface temperatures in large machines with the idea that real information concerning conditions affecting the life of the insulation is being obtained.

Three sources of information are now available from which an estimate of safe temperatures may be made: Measurement of internal temperatures in generators that have been in service with the same coils for a sufficient length of time to represent a reasonably long life; comparative life tests of materials at abnormally high temperatures in order to bring the time of the tests within practicable limits; comparison of losses and surface temperatures of generators that have been in operation a long time, with the same factors of newer generators of similar design and proportions for which internal temperature measurements are also available.

A safe temperature limit of 105 deg. C. was given for treated cotton, paper, silk and similar fibrous materials. A temperature limit of 105 deg. to 125 deg. C. was suggested for combinations of the above materials with mica or similar heat-resisting materials when both classes of materials are depended upon for insulation strength. With combinations of the same materials, but in which mica and similar heat-resisting materials furnish the entire insulation strength, a limit of 150 deg. C. was suggested.

Discussion

Mr. C. W. Stone, Schenectady, N. Y., expressed the wish that the cooling effect of the moisture in the air might be utilized in electrical apparatus. In Germany experiments have been made with water-cooled coils, but it is a difficult mechanical proposition to carry the water near enough to the coils to do any good. The whole question of insulation is a compromise. Thick, fibrous material means low heat transference. If thin insulation is required, other problems arise. In machines of small bulk and large capacity mica with some binding material will probably be used almost exclusively. Designing engineers do not care if the mica burns away, as it will stay in place even under such conditions. The speaker said that greater care should be used in designing end coils for free air passage and advocated getting away from conditions approximating those found in slots. Wide separation of end turns is necessary. There is practically no limit to the temperature at which turbo-alternator fields can be operated, as mica will stand any temperature up to the melting point of copper. In studying temperatures it is desirable to ascertain the degree of heat present between coils and slots in order to get at the real conditions. Engineers are often fooled by thermometer measurements made on the surface of machinery.

Mr. A. S. Loizeaux, Baltimore, Md., cited the deterioration of varnished-cambric installations in 13,000-volt and 4000-volt machines operated in his city, and suggested the possibility of operating temporarily on very high overload, by the use of the thermocouple. Mr. J. E. Kearns, Schenectady, said that the committee is not trying to standardize the form of connections, but merely their nomenclature. The problem of handling overloads is largely up to the station operator, and with the temperature-indicating equipment now available machines can be run much closer to their heating limits than previously. In emergencies where it is necessary to maintain the service at all hazards it is sometimes necessary to sacrifice the life of the insulation by running the machines at very heavy outputs far beyond their reasonable overload capacity.

Prof. E. E. F. Creighton, Schenectady, N. Y., outlined the use of aluminum-cell lightning arresters in connection with commutator machines, to prevent flashing. This practice grew out of early experience in the application of arresters of this type to direct-current

circuits. Contrary to many ideas, the latter are subject at times to very severe surges and rises of potential. About 4 amp for each volt of increase of potential above normal will flow in the arrester. Arresters of this type have been used very successfully in connection with 2000-kw synchronous converters, which had a tendency to flash over. The usual practice is one arrester to every 500 kw of machine rating.

Mr. Newbury emphasized the popularity of motor-starting for synchronous machines in England and said that the efficiency of synchronous converters is one of the chief causes of their increased popularity in lighting service. He said that there is a choice in many cases between using circuit-breakers and aluminum-cell arresters in connection with commutator machines, as a circuit-breaker may cause a machine to flash over on a moderate short-circuit, say two or three times its rated current. In closing, the speaker said that most modern machines can be run at very high temperatures, even up to 200 deg., for one or two hours in emergency.

Mr. Elden, in closing, referred appreciatively to the assistance given by Mr. Newbury's paper to the standardization work of the committee.

Report of Committee on Prime Movers

The report of the committee on prime movers, of which Mr. I. E. Moultrop is chairman, occupied more than ninety printed pages and treated the topics of steam-power, water-power and internal-combustion engines. For stand-by service at St. Louis the scheme of building rapid-kindling coal fires (described in the *Electrical World*, Dec. 6, 1913) was found quicker and cheaper than oil-burning. At Boston steam blowers have been used with advantage to secure forced draft on boilers during peak periods, raising the steaming output quickly by 150 to 200 per cent. Cinder particles discharged from the stacks at high draft are collected at New York by impinging the flue gases against a wet baffle plate, the cinders being caught in a water trough. Several stokers have now been in successful use for burning pulverized coal and in the opinion of the committee deserve greater attention. In view of the high cost of the pit necessary for underwater coal storage and the security of properly selected storage coal against ignition, the committee considers the construction of special pits unwarrantable. A more refractory firebrick is needed, as modern boiler practice has already approached the limit of temperatures for clay products.

In condenser design the committee is gratified at noting the larger steam passages allowed. Open-hearth seamless-steel boiler tubes are now being largely specified and are used with success. The application of "efficiency instruments" has not been attended by the results contemplated, for the reasons that the instruments themselves easily get out of order and careful study and comparison of the records is required in order to diagnose troubles. Letters from manufacturers describing recently developed apparatus formed a supplement to the section on steam-power practice.

Under the heading of water-power reference was made to the paper by Mr. O. B. Coldwell presented before the convention. Methods of measuring flow at water-power plants were also tabulated and discussed. While center bearings between runners on waterwheel sets permit of smaller shaft sections, they introduce the disadvantage of inacessibility and involve the danger of not sharing the bearing load. Forced lubrication is required where bearings cannot be reached. The Kingsbury type of thrust bearing has been giving excellent service at the Keokuk plant.

During the past year there has occurred a continued recedence of the gas engine and producer plant in contrast with the remarkable growth and development of the steam-turbine plant. On the other hand, many prominent engine builders have taken up the manufacture of oil engines. European practice is markedly reflected in American oil-engine design. A commercially practicable gas turbine is shortly to be marketed abroad. Five American firms are now making Diesel-type oil engines, and half a dozen others have acquired rights to other types of similar engines. Appendices to the internal-combustion section of the report give information concerning the location of oil engines in the United States, prices of oil, petroleum production, etc.

Discussion

Mr. T. C. McBride, Philadelphia, said that the committee has been duly severe upon the designers of condensers, and that the equipment compared in diagrammatic form in the report is in reality not suited to uniform service. Instead of showing the apparatus with the heads at the same level, the tops of the tail-pipes should be placed at the same level in comparing the relative heights of the apparatus. It is desirable to differentiate between the area required for the exhaust nozzle and the area needed for the distribution of steam

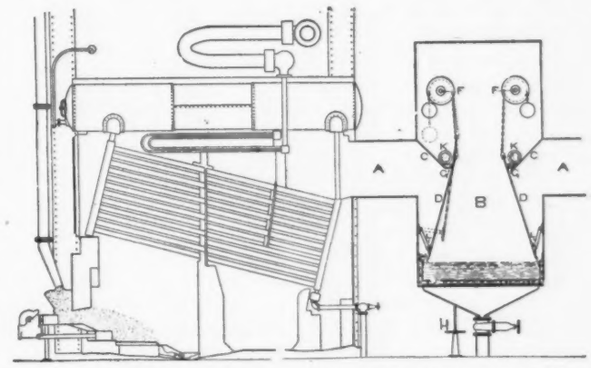


FIG. 1—REMOVING CINDERS FROM FLUE GASES, NEW YORK EDISON COMPANY

to the tubes. In Europe a tendency toward the use of larger exhaust nozzles is apparent in condenser design. With the demand for greater vacua and consequently increased volumes of steam and larger passages, baffle-plates are necessary only to permit the steam to sweep the air through the condenser to prevent the formation of pockets. Condensers designed for rolling-mill service handle sudden large volumes of steam and differ in construction from those suitable for central stations. Mr. McBride said that he anticipates a development of the hydraulic vacuum pump along the lines of the Mueller equipment shown in the report. Closing, he predicted a notable development of oil engines designed to handle crude fuel and especially adapted to American labor and operating conditions. Engines of this type are likely to become useful in handling stand-by service.

Venturi Meters for Water-Power Plants

Mr. Clemens Herschel, New York, pointed out that the Venturi meter is capable of measuring the water requirements of the hydro-electric service within one-twentieth of 1 per cent. This device has been successful for a quarter of a century in water-works plants and is far superior to weirs and home-made methods of measuring water flowage. It is exceeded in accuracy only by the tank method. Venturi meters can be used either on the penstock or at the tailrace as desired; the rate of discharge through the wheel can be set for testing and a constant watch by this device can be kept upon the efficiency of hydraulic prime movers. The

registers are still controlled by patents, but in their place the manometer tube and the home-made scale are most convenient. This apparatus is equally well adapted to the measurement of hot water in boiler feeding.

Mr. F. H. Varney, of the Pacific Gas & Electric Company, San Francisco, Cal., said that the present output of the Pacific system is 400,000 kw-hr. per day, of which 50 per cent is delivered by the hydro-electric system. The average load throughout the day is 24,000 kw, and if an emergency demand arises for 10,000 kw to 12,000 kw it can be instantly met by turbo-generators kept floating on the busbars. The normal operating steam pressure is 200 lb., and the boilers are kept hot enough to pick up the load instantly in case of trouble. Each furnace is equipped with oil burners by which the load can be assumed without the loss of a single cycle or a perceptible voltage drop. When a load of the above magnitude is suddenly assumed the steam pressure falls perhaps 40 lb., but the high initial pressure carried renders this of little consequence. The fuel oil is discharged into the furnace hot and in a practically gaseous form.

Selection of Hydraulic Turbines

It was pointed out in the paper on "The Selection of Hydraulic Turbines," by Mr. Charles V. Seastone, that lack of proper data on the characteristics of different types of waterwheels has, to a certain extent, been the cause of installing turbine equipment which is unsuited to the conditions under which it operates. Tests on the smaller-sized waterwheels compared with the actual results of large installed units indicate that the characteristics of different sizes of machines having homologous parts are essentially the same.

Where proper speeds can be secured without increasing unduly the number of turbine runners the horizontal type of waterwheel in ordinary sizes will usually prove more economical in installation and operation. Larger units under considerable head are more desirable in the vertical design as the substructure will usually cost less.

A sufficient number of units should be installed in a station operating under ordinary commercial loads to insure each unit's carrying a reasonably high percentage of its full rated load during the major portion of the time. The reserve unit, if one is installed, should be as small as is practicably possible so that too much equipment representing a heavy investment will not be standing idle. Ordinarily turbine units rated at 125 per cent of their connected generator should be selected so that they can be operated at about eight-tenths of full gate opening. Careful consideration should also be given to selecting units which will operate at high efficiency under a range of heads. Curves were shown

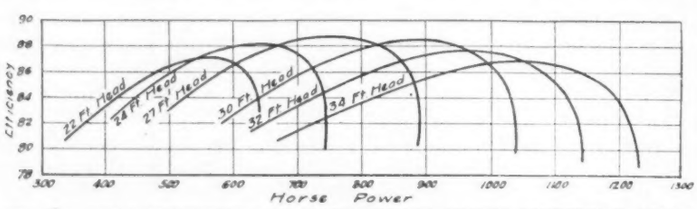


FIG. 2—CHARACTERISTICS OF WATERWHEEL UNDER DIFFERENT HEADS

indicating how two machines having the same efficiency at a definite load might have widely differing efficiencies above or below this particular load. Other curves showed how machines made by different manufacturers behave under varying heads.

An interesting method of operating five four-runner turbines was described which allows very flexible operation. The gates of two pairs of runners are operated either individually or together by separate regulating shafts which extend outside the bulkhead wall and are connected to the gate-operating mechanism. These gates may be operated by hand without interfering with the governor control. It will thus be seen that with such an arrangement the number of hydraulic

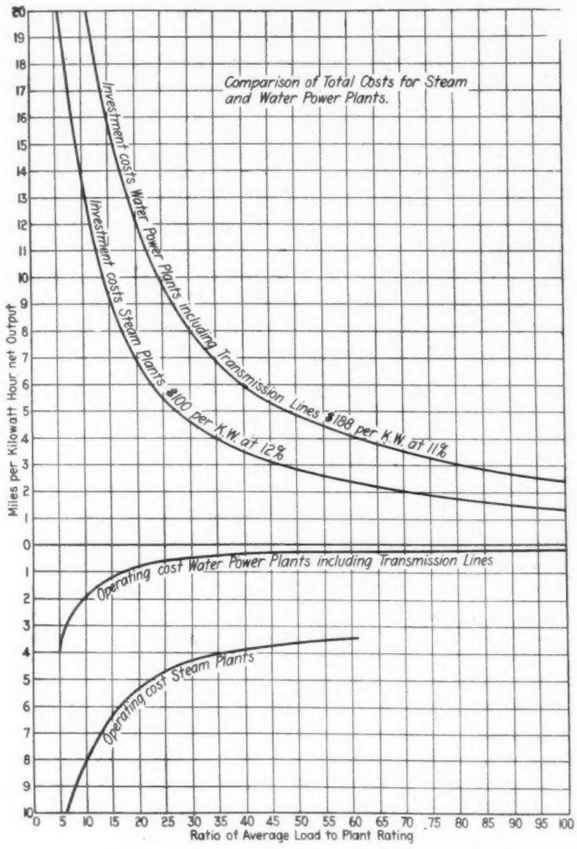

Comparison of Total Costs for Steam and Water Power Plants.
Investment costs Water Power Plants including Transmission Lines $188 per K.W. at 11%
Investment costs Steam Plants $100 per K.W. at 12%
Operating cost Water Power Plants including Transmission Lines
Operating cost Steam Plants
Miles per Kilowatt Hour net Output
Ratio of Average Load to Plant Rating
0 5 10 15 20 25 30 35 40 45 50 55 60 65 70 75 80 85 90 95 100

FIG. 3—WATER-POWER PLANT ECONOMICS

units is practically doubled, with a consequent increased flexibility of operation and efficiency, and without any appreciable sacrifice in efficiency, except in the generators, which is but a small percentage.

Hydroelectric Progress

Mr. T. C. Martin presented a sixty-two-page report setting forth the present status of electric transmission from hydraulic development, discussing in a broad way various aspects of water-power and conservation problems in national and state legislation. Reference was made to the work of the Fifth National Conservation Congress at Washington, D. C., in December, 1913, and an outline was given of the bills proposed by Secretary Lane of the Interior Department and Secretary Garrison of the War Department, under which water-power resources may be developed. Evidences of a more constructive attitude on the part of the government toward hydroelectric development were frequent in the report, and a number of permits granted by the federal authorities were succinctly set forth.

Recent Installations

The last section of the report was devoted to the description in outline of the most recently completed hydroelectric installations and transmissions in this

country and abroad, and many points bearing upon transmission-line practice, station design, substation construction, and other practical matters were included. As a résumé of the projects set in motion commercially during the past year the report fulfils a distinct need and presents in small compass data applying to the entire field of hydroelectric transmission.

Water-Power Plant Economics

In a paper on "Water-Power Plant Economics" Mr. O. B. Coldwell presented curves on investment charges and operating costs for steam and hydroelectric generating plants, and discussed steam and watershed, various types of hydroelectric plants, headwork and intakes, types of conduit, penstocks, pondage, main units and generators, and draft tubes and tailraces.

If there is any choice, it is generally preferable to select a stream with a low ratio of flood discharge to minimum flow in order that as much power can be developed as possible without having a large proportion of the equipment lying idle during minimum stream flow. Inasmuch as the majority of streams deliver considerably more water throughout the greater part of the year than is available during minimum stream flow, generating equipment in excess of that capable of utilizing the low flow should be installed. As a valuable treatise on hydroelectric plant economics, Mr. Coldwell recommended Dr. Cary T. Hutchinson's paper on "Economical Capacity of a Combined Hydroelectric and Steam-Power Plant," read at the March meeting of the American Institute of Electrical Engineers and abstracted in the *Electrical World* on March 7.

In making a comparison between the relative merits of several types of plants, consideration should be given to the permanency or life of various structures as affecting depreciation charges, repairs and reconstruction. Dams which do not leak water are essential. Intakes and racks should be constructed with sufficient cross-section to prevent excessive friction loss. The design of control gates, fender booms, splash-boards and spillways was touched upon.

Among various types of water conduits which are in use the paper referred to the construction of the wooden-box type, reinforced-concrete flumes, wooden-stave pipe, steel-pipe, and rock-lined tunnels. A very important feature to consider in designing a flume is the transition from one shape of conduit to another. Unless such junctions are properly designed loss of head will result. The author called attention to the use of electrically operated flume gates for emptying the conduit in case a break occurs below the gate. A bell-mouthed penstock will often obviate a loss in head which may be considerable. Co-operation between purchasers and manufacturers of waterwheels was recommended in order to secure a design most suited to the particular operating conditions.

Whenever water storage can be employed large production economics can usually be obtained. A case was cited where a timber storage dam increased the minimum flow by from 25 to 30 per cent. If plants without storage are operated in conjunction with other plants having forebay pondage, the fluctuations in load can be handled economically by carrying the base load at the plants without ponds.

Numerous devices are used to improve the operation of generating plants. Among those mentioned or described were head-water and tail-water level indicators, water-flow measuring devices, hydraulic and motor-operated valves, water-cooling systems, and overspeed safety devices. Standpipes or pressure-equalizing reservoirs are advisable when long penstocks delivering water at high speed are employed. Synchronous pressure regulators may be used when the cost of a standpipe is prohibitive. A plant should be situated with respect to the tailrace so that full advantage is taken of the draft therein.

Switchboards should be compactly arranged so that the operator can perform all duties from one locality, thereby saving time during emergencies. Electrically operated headgates were advised.

A letter from Mr. Herrmann V. Schreiber, of Sellers & Rippey, Philadelphia, was appended to the paper. The writer suggested other subjects which might be included to advantage in a treatise on hydroelectric plant economics. He also recommended keeping records of water flow in different parts of a plant.

Discussion

Mr. W. N. Ryerson, Duluth, Minn., pointed out that in high-head projects associated with storage capacity the point is reached beyond which the cost of each additional increment of stream flow secured by the enlargement of storage facilities is greater than the cost of auxiliary steam plant or other outside service. The speaker said that the loss of energy in water pipes can be figured along the lines corresponding to Kelvin's law. Mr. A. S. Loizeaux, Baltimore, suggested the value, in some instances, of framing contracts for the purchase of power upon a basis by which the hydroelectric plant may be operated on the peak alone during the dry season, carrying the balance of the service by the auxiliary steam plant. In some cases the latter may thus be run on the day load at a load-factor of nearly 100 per cent.

TRANSMISSION AND DISTRIBUTION

Report of Committee on Grounding Secondaries

Mr. W. H. Blood, Jr., Boston, Mass., presented the report, which urged member companies to explain to water-works companies and municipalities the harmlessness of the water-pipe ground. An inquiry answered by 575 member companies disclosed the fact that only 325 are grounding secondaries. The records show that all of the larger companies adhere to the practice and point out that, in spite of the cost, the smaller central stations cannot afford to take the risk of not falling into line. In many cities the cost of one accident would more than pay the cost of grounding, which is good business apart from the humanitarian aspect.

In 222 locations where grounding to water pipes is allowed only 112 companies make use of this method, the others apparently failing to appreciate the merits of the practice. A total of 131 municipalities have admitted that a ground wire does not injure their piping, and eighty-three privately owned plants have acknowledged the same thing. Driven pipe and cone grounds are entirely unsatisfactory, and the report strongly condemns the continuance of the practice, which is not permitted by the National Electrical Code. Where water meters are located at the curb line, as in some Southern cities, a shunt wire connected around the meter with the usual ground connection in the house is the best practice. The street-railway ground return works out well where one ground connection to a transformer is used.

Discussion

Dr. C. P. Steinmetz said that engineers are agreed that the grounding of secondaries is the only proper method of taking care of the fire and life hazard and that any central station omitting the practice lays itself open to charges of criminal negligence in case of accident. Mr. Dudley Farrand, Newark, N. J., stated that an elaborate report on the safety of grounding secondaries to water pipes had lately been presented

to the Public Utilities Commission of New Jersey by Prof. Albert Ganz, and that by a recent ruling the authority of the State to regulate the grounding of secondaries in residences had been upheld as against a municipality. Others who spoke briefly were Messrs. A. S. Loizeaux, Baltimore; C. L. Campbell, Waterbury,

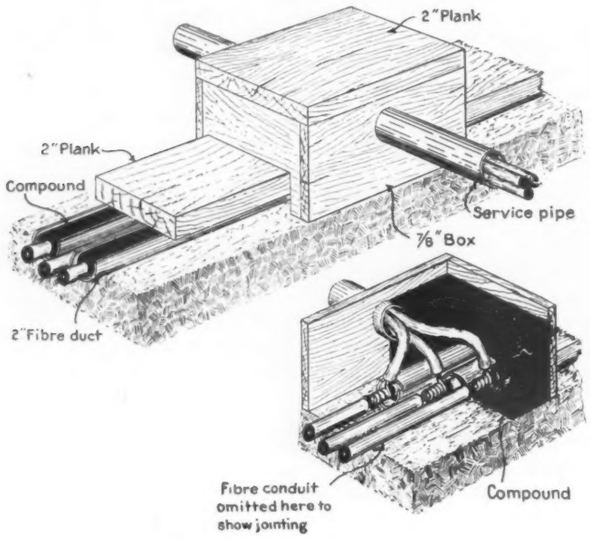


FIG. 4—ORDINARY LINE WIRE LAID IN SPLIT-FIBER PIPE WITH SERVICE CONNECTION

Conn.; George P. Roux, Altoona, Pa., and H. Calvert, Philadelphia.

Underground Construction

The report of the committee on underground construction, of which Mr. Philip Torchio was chairman, consisted of six separate contributions on the subjects of alternating-current underground distribution systems, underground transformers, high-tension cable joints, protection of cables in manholes, low-cost underground distributing systems and operating data on high-tension cables.

The first section discussed the practice of using junction boxes, fuses, oil switches and other devices for sectionalizing and interconnecting purposes. As primary cables usually contain several conductors, it is advisable to provide emergency connections which will facilitate restoration of service and safety to workmen during repair when failure in one conductor damages those adjacent to it.

In another section of the report it was declared that underground transformers can be connected directly to the primary mains without automatic protection. Oil switches are frequently installed in the primary connections, however, to provide means for disconnecting the transformer without unbalancing the circuit. The report states definitely that emergency relief valves or vents on transformers are entirely unnecessary, and their omission is recommended, as most of the trouble with underground transformers is caused by their use. Three cubic feet of manhole space per kva of transformer rating was suggested as being sufficient in temperate zones when only a perforated manhole cover is provided for ventilation and moderate-sized units are employed. When 200-kva transformers or larger are installed in spaces less commodious special ventilation must be provided. Natural ventilation is preferred in all cases, but blowers may be installed.

Although considerable improvements have been made in the manufacture of high-voltage cable, the original method of making cable joints, despite its imperfections, is still employed. Results of tests by a large company on a number of 15,000-volt cable joints showed that out of nine splices examined six failed between 50,000 volts and 63,000 volts, one withstood 65,800 volts for four minutes, and two withstood 70,000 volts for twelve minutes. The vacuum process of making joints was recommended.

Tests made recently to determine the relative value of two types of protective cable covering show cement mortar to be superior to asbestos or steel-tape covering. An objectionable feature connected with the asbestos covering is the presence of the iron banding tape, which may become grounded and thus actually become involved in an arc circuit, which condition cannot exist when cement covering is used.

Attention was called to the fruitless efforts which have been made to develop an inexpensive underground distributing system. Among methods of underground construction which are fairly comparable in cost with those on overhead systems are the use of armored cable and split-fiber conduit laid in the bare earth. An installation of 55 miles of lead-covered, steel-armored cable laid bare in earth was described briefly. Eighty per cent of the cable has been in service about four years and only one fault has developed in that time.

COST OF UNDERGROUND EQUIPMENT

CONDUCTORS		APPROXIMATE PRICE PER 1000 FEET		
Number	Size, B. & S. Gage	Additional Cost of Steel Tape Armor	Iron Pipe	Fiber Pipe
Two.....	No. 8	$42.00	$71.00	$31.00
Two.....	No. 6	45.00	71.00	31.00
Two.....	No. 4	56.00	112.00	34.00
Three.....	No. 6	47.00	112.00	34.00
Three.....	No. 4	59.00	112.00	34.00
Three.....	No. 1	69.00	146.00	37.00
Three.....	No. 2-0	80.00	146.00	37.00

A similar relatively inexpensive installation was referred to consisting of ordinary line wire laid in individual fiber ducts filled with insulating compound and buried in the earth. Eight years' service seems to indicate that this construction is satisfactory. The cost

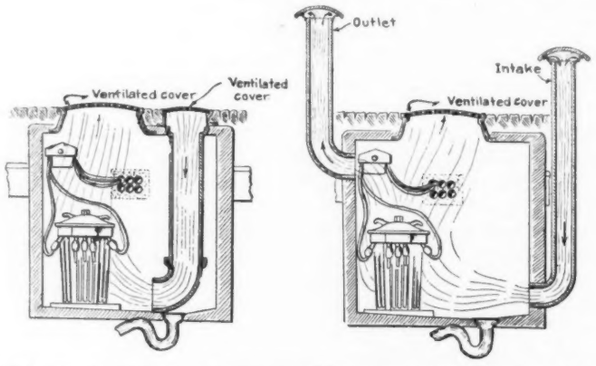


FIG. 5—METHODS OF VENTILATING TRANSFORMER MANHOLES

of installing was about 75 cents per foot. In drawing-in systems there are some cases where an uninsulated neutral may be employed with a reduction in the cost of construction. The use of a non-insulated neutral is particularly applicable to locations where a single transformer supplies a group of low-tension feeders and

where the grounding of the secondary system is made at the transformer, with no grounding connections on the customers' premises.

Section six gives operating data on high-tension cables collected from seventeen companies. A marked difference is shown in the thickness of insulation used by them for cables of relatively low voltages, but greater uniformity for high-voltage cables. The maximum allowable loading employed by different companies gives temperatures varying from 90 deg. to 150 deg. Fahr. in the lead sheath, and tests made to supplement this information show that the temperature of the conductor would be as much as 75 deg. Fahr. higher than that of the sheath. Attention was called to the possibility of varying the maximum loading with the seasons of the year. The cable burn-outs for 2300 miles of cable were 14.2 per 100 miles, of which 78 per cent were in cable sections and 22 per cent in joints. The burn-outs were attributed to electrolysis, extraneous injury, sharp bends in manholes, defective cable, badly made joints and surges due to lightning or trouble on overhead lines joined to the underground cables. A majority of the companies apply a break-down test of 150 to 200 per cent of the working voltage to the new lines for an average of five minutes. Only six companies make any break-down tests on old cables, the voltages used ranging from 125 to 200 per cent, applied for five minutes.

Discussion

Mr. Loizeaux questioned the advisability of measuring cable temperatures at joints or near the end of ducts by the apparatus now available for generator temperature readings. Mr. E. Z. Wallower, Harrisburg, Pa., urged eliminating the underground transformer as far as possible. He described several basement substation installations on the distribution system of the Harrisburg Light & Power Company, which the speaker contended practically do away with underground transformers. Each small substation cares for about one-third of the commercial lighting district, and the substations are tied together on their secondary sides, to provide first-class service. They are fed by a three-conductor, 6900-volt, three-phase cable, looped from the main substation of the company, in which is a small high-tension switchboard, provided with reverse-current relays. The transformers in the small substations are connected to single-phase lines, phase-shifting switches being provided.

Mr. R. C. Powell, San Francisco, Cal., submitted a written discussion of the difficulty of manhole operation in districts subjected to severe tides. Fans have been tried in some places for ventilating manholes, but without much success, and as a rule the ventilation of manholes by pipes is not practicable. The insurance companies often object to the attachment of such pipes to buildings. There were six burn-outs last year on the San Francisco system of the Pacific Gas & Electric Company, with over 7000 kw of transformers installed in manholes. Experience shows the necessity for tight covers. Mr. H. L. Wallau, Cleveland, Ohio, said that heating tests of cable run in split tile, in asbestos and cement wrapping showed that the last-named had the best dispersion of heat.

Mr. E. W. Stevenson, New York, pointed out the need of a substitute for paraffine, which shrinks if cooled quickly and admits air. Closing, Mr. Elden said that in his opinion there are serious mechanical difficulties in connection with any proposed installation of heat-measuring devices on underground cables. The satisfactory ventilation of manholes containing 300 kw or more in transformers is a difficult problem. The committee will be very glad to study cable troubles whenever member companies supply it with the necessary information.

Overhead-Line Construction

The committee on overhead-line construction, of which Mr. Thomas Sproule was chairman, presented as its report a revision of the first two sections of the 1911 report, covering primary and secondary line construction. The committee's report is printed in full in a "Handbook on Overhead-Line Construction" prepared by a sub-committee of the main committee.

The handbook contains, in addition to the committee's report, descriptions of the methods and materials employed in overhead-line construction; also the necessary formulas for the electrical and mechanical solution of transmission and distribution problems.

Contained in the handbook are an abridged electrical dictionary and several tables; data on wooden, reinforced-concrete and steel poles and towers; conductor and wire tables; general information on cross-arms, pins, line hardware, insulators, insulator manufacture, insulator characteristics, etc.; information regarding transformers, regulators and lightning in connection with electric circuits and protective apparatus; electrical calculations of alternating-current and direct-current systems; mechanical calculations for wire sag, strength of poles, etc.; general data on wood preservation; recommendations of the National Electric Light Association committee on wood preservation; American and German government data on the preservation of timber; primary and secondary line construction; effects of weather conditions on electrical equipment, and methods of resuscitation.

Attention was also called to a report on joint-pole usage prepared by joint committees of the American Electric Railway Association, the National Electric Light Association, the American Institute of Electrical Engineers, and the American Telephone & Telegraph Company, which will be presented at the fall convention of the first-named association.

Discussion

Following the reading of the report, Messrs. J. F. Gilchrist, Chicago, and H. A. Wagner, Baltimore, congratulated the committee upon the production of its 800-page handbook on overhead-line construction.

Voltage-Limiting Resolution

The following resolution was then introduced by Mr. A. C. Einstein, St. Louis, Mo.:

"Whereas, at the annual convention of the National Electric Light Association in the year 1911 there was presented a report by the committee on overhead-line construction, to which the executive committee then gave its qualified approval, since which time the progress in the state of the art and the continued good work done by the committee have developed recommendations of better practice which the overhead-line-construction committee now presents to this convention, therefore be it resolved, That the thanks of the association are due and extended to the overhead-line-construction committee for its sacrificing and painstaking efforts, and, in view of the later recommendations of that committee, that the heretofore qualified approval of the 1911 report is hereby rescinded, and that the question of voltage limitation shall be eliminated from any recommendations or reports of any committee of this association, by inference or otherwise, with relation to overhead-line-construction practices, and that any such recommendations or specifications to this or previous conventions by any committee shall not be sanctioned by this association."

The resolution was carried by a large majority, and a motion to reconsider it was lost. Advocates of the measure described the difficulties small central stations have encountered as a result of voltage limitations sponsored by the association, in its overhead-line specifications, reports, etc., and pointed out that more advan-

tageous relations with other public utilities are sure to follow its adoption.

Resolution on Overhead Line Construction

At the opening of the third technical session Chairman Sproule of the committee on overhead-line construction introduced the following resolution, which was carried by unanimous vote:

"The committee on overhead-line construction recommends that the approval of Section 3 of the 1911 report be rescinded and that Section 4 of the report be changed to read as per the following:

"1. Scope: These specifications shall apply to overhead electric light and power line crossings (except trolley contact wires), over railroad right-of-way, tracks or lines of wires."

Following this, Mr. A. C. Einstein, St. Louis, Mo., moved the passage of the following resolution, which also went through by acclamation:

"Resolved, That the National Electric Light Association, as an association, believes that no specification for the joint occupancy of pole lines having a voltage limitation feature by inference or otherwise should be approved or adopted as its standard."

Electrical Disturbances in Transmission Work

In a paper on the "Nature of Electrical Disturbances in Transmission Work," by Messrs. D. B. Rushmore and E. A. Lof, the disturbances are divided into those caused by high currents and those caused by high voltages. The destructive effects of high currents may be reduced by increasing the reactance in the circuits by providing external reactors and so sectionalizing the system through selective switching devices that the disturbances will be confined to the smallest possible area. With reference to high-voltage disturbances, the authors point out that the regulation of modern transmission systems is generally improved by providing synchronous condensers with automatic voltage regulators. The field is then adjusted so as to make the condenser take a lagging current at no load and a leading current at full load, the first to offset the effect of the line capacity and the second to offset the surplus lagging-load current. The aluminum-cell lightning arrester protects against high-voltage disturbances occurring between the phase conductors or between the phase conductors and ground. Overhead ground wires are also very generally used to protect the line against atmospheric charges. Means for protecting against disturbances due to high frequency are being studied and investigated, and since these disturbances are liable to damage the interior of transformer windings, the authors say it is advisable to insulate heavily not only the end turns of the windings but the coil groups as well. Inductances and energy-absorbing devices may also be added for further protection.

High-Tension Transmission Systems

Mr. Selby Haar, New York, presented a paper in which were outlined the features of existing transmission plants designed for operation at 70,000 volts or over, as contributed by him in an article published in the *Electrical World* of April 25, 1914. A number of interesting deductions were set forth which were not specified in the original article. The average voltage per mile of these systems is slightly over 1200, the limits being 4590 and 440. It appears probable that the transmission voltage will continue to increase as fast as suitable apparatus can be built. A generator of highest rating in these plants is 18,000 kva, and the smallest is 750 kw. Specified power-factors range generally from 0.80 to 0.90.

From the data on transformers it appears that very large single-phase units are still being installed, apparently owing to the difficulty of transporting large three-phase units. In most cases delta connection is used for at least one of the windings. The longest transmission is about 240 miles, the normal span ranges from 450 ft. to 850 ft., and most lines are strung on double-circuit towers. The hemp center seems to have been supplanted in conductor design. The average spacing of conductors and the number of insulating shoes depends almost entirely upon atmospheric conditions and the topography of the region traversed. Under lightning protection the overhead ground wire is firmly established and electrolytic arresters are widely popular. The arc suppressor is also gaining adherence, and something is being done under the heading of excess voltage protection to prevent the formation of surges by the proper proportioning of switching devices, ground wires and line constants. The use of outdoor switching apparatus is steadily increasing.

LAMPS AND ILLUMINATION

Report of Committee on Street Lighting

This report was presented by the chairman of the committee, Mr. John W. Lieb, Jr., New York. It contains a historical introduction summarizing the work of the committee since 1898, a statement of the fundamental objects of street illumination and a discussion of experimental street lighting upon Intervale Avenue, borough of the Bronx, New York City, with several appendices. Through the courtesy of the municipal authorities the committee has been able to arrange for the installation of a considerable variety of street-lighting equipment which will be studied from many angles. In addition to the usual illuminometer tests the psychological aspect of the subject has been taken up and an entirely new point of view gained in connection with methods of observation. The committee has secured the interested cooperation of Prof. Hugo Munsterberg, of Harvard University, one of the best-known phychologists in America, in mapping out observational methods. These include such points as the ability to distinguish faces of persons on sidewalk, to see irregularities in sidewalk paving, to read print, to see house numbers, to tell time from a watch and to distinguish obstructions, the curb line, vehicles, etc. Tests with observational targets of various types have been made and a large number of photometric observations compiled. Tables of data comparing the test street with an intersecting thoroughfare are included, and a useful feature of the report is a tabulation of street-lighting data for three groups of cities in the United States, classified according to population. A singular result of the target tests is that non-uniform lighting from large sources widely spaced reveals about as many targets as does uniform lighting from smaller sources, closely spaced. The explanation appears to be that in the non-uniformly lighted street the light at most points comes chiefly from one source which dominates all other sources and either lights certain surfaces of the targets much more brightly than other nearby surfaces or else leaves certain surfaces in shadow. Strong contrasts are produced by light which is mainly unidirectional. On the other hand, a light at any point in the uniformly illuminated street is received from a number of sources, none of which dominate to so large an extent. Hence contrasts are smaller. The work of the committee seems destined to advance the state of the art in this important department of municipal lighting.

Following the presentation of the report, Mr. J. W.

Cowles, Boston, Mass., expressed his appreciation of the committee's contribution to methods of investigation in the street-lighting field, and Mr. Lieb said that ultimately tests will be made on streets upon which high buildings with light-distributing fronts are located. The work now under way is certain to last all summer.

At the close of the report the association's moving-picture film, "The Lineman," was exhibited to an appreciative audience.

In reading the paper special attention was called to a method of regulation in which a booster directly connected to a synchronous condenser is connected in series with the transformer, thus giving the plant operator a flexible control of both voltage and power factor, either together or independently.

Report of the Lamp Committee

The report of the lamp committee, of which Mr. Frank W. Smith is general chairman, Mr. Joseph D. Israel being chairman of the sub-committee for the Commercial Section, was this year presented in two parts—one dealing with the general and technical part of the lamp business and the other covering the commercial aspects of the lamp situation.

During 1913 more than 100,000,000 lamps were sold —an increase of 59 per cent over the total sales for 1907 and about 13 per cent over the sales for 1912. During 1913 the output of carbon lamps was less than 11 per cent of the total, about 60 per cent of the entire number being tungsten units. The report included a general description of the new nitrogen-filled lamps and discussed methods of popularizing the use of tungsten units, particularly in the larger sizes. The committee recommended that member companies make free renewals of tungsten lamps, following the policy already initiated by some of the companies beginning with August of last year.

The commercial section of the report discussed the practices of making installations and renewals followed by the principal central-station organizations of the country. The opinion was expressed that the policy of including the 60-watt tungsten unit as a free-renewal lamp will be the means of replacing great numbers of 16-cp graphitized-filament lamps and, owing to the small increase of consumption, will keep installations intact and be the means of increasing the connected load. The report was supplemented by a number of replies received to inquiries regarding lamp installation and renewal practices in cities of 5000 people and larger.

Exhibit of Lighting Units

The committee's exhibit of newly perfected lighting units was demonstrated by Mr. Preston S. Millar, New York. The development of the lighting art has proceeded so rapidly during recent months, said Mr. Millar, that the central-station man now finds himself confronted by an embarrassment of riches in the field of high-efficiency illuminants.

An interesting historical collection first shown by the speaker traced the development of incandescent units from the bamboo-filament lamps of 1880, through the treated carbon-filament lamps of 1892 and the metal-filament units of 1906, to the newest "half-watt" non-vacuum tungsten lamps of 1914. All of these lamps, including the priceless early relics, were shown in actual operation. Other lamps exhibited by the speaker included the smallest 110-volt tungsten lamp commercially manufactured, which is rated at 10 watts; the largest vacuum-type tungsten lamp, 500 watts; the smallest non-vacuum lamp, 400 watts; the largest non-vacuum lamp commercially manufactured, 1000 watts; the smallest miniature tungsten lamp, the "grain-of-wheat" type, which is rated at 0.1 watt, and a very large non-vacuum type tungsten lamp developed thus far in the laboratory only and rated at 2500 watts. Another group of large non-vacuum lamps was exhibited to show the bulb discoloration following 800 hours' burning. The Hewitt method of "ruling" lamp bulbs to secure diffusion was also demonstrated.

As examples of modern large-size lighting units the exhibit included a 10-amp flame-arc lamp (0.5 watt per cp), a quartz-tube mercury-vapor lamp (0.6 watt per cp), a nitrogen-filled tungsten lamp (0.75 watt per cp), a magnetite-arc lamp (1 watt per cp), and a titanium-carbide lamp, not yet marketed, having a power consumption of 0.4 watt per mean spherical cp. Recent improvements in the magnetite-arc lamp, said Mr. Millar, will improve its efficiency by 40 per cent. The maximum attainable theoretical efficiency in the production of yellow-green light (the wave-length to which the retina is most sensitive) has been placed at 65 cp per watt, while for white light perfect efficiency of luminous conversion is represented by 21 cp per watt. In the last year or two long steps have been made in this direction, concluded Mr. Millar, luminous efficiencies having been improved until the present figure of 2 cp per watt has been commercially reached.

Mr. J. W. Howell, Harrison, N. J., pointed out the advantages and economies of standard voltages for lamp operation. The 25-watt and 40-watt tungsten lamps of to-day, he added, are at least "twice as good" as similar lamps of a year ago. This result, which has been brought about by the introduction of chemicals into the lamps, is now being extended to even smaller sizes. The future development of the non-vacuum lamp, said Mr. Howell, will be in the substitution of other gases inside the globe which will reduce the cooling effect on the filament. This change will also make the non-vacuum lamp available in smaller sizes since it will be possible to employ smaller filament diameters. Excepting the difficulties of mechanical construction, there is, he said, apparently no upper limit to the sizes in which these large non-vacuum lamps may be built.

Mr. S. E. Doane, Cleveland, said that as the result of the co-operation of the N. E. L. A. a degree of standardization exists in the lamp industry of this country which is without a parallel elsewhere.

Mr. J. O. Carr, Schenectady, N. Y., asked why the 60-watt lamp should be taken as the dividing line for free renewals. Mr. Norman Macbeth, New York, pointed out the increase in candle-power sizes as revealed by the committee's report. Some companies, he said, have felt the cost of etching lamps to be greater than the outlay due to loss by theft.

Mr. S. G. Rhodes, New York, and Mr. S. B. Burrows, Newark, N. J., also discussed lamp topics briefly.

In closing the discussion Chairman Smith said that the wisdom of the liberal renewal policy of American central stations is attested by the high average candle-power of the lamps produced in this country, 29.4 cp, whereas in Japan, where a different renewal policy is followed, the average lamp produced is only 8 cp. Mr. Israel, chairman of the Commercial Section sub-committee, explained that the replies listed in the supplement were received from sixty-five companies, including both large and small central stations.

Lighting Interurban Highways

The committee on the lighting of interurban highways, of which Mr. G. B. Tripp, of Harrisburg, is chairman, found few data available outside of cities and villages, this class of business having received comparatively little attention. Subsequent investigation indicated that the scheme offers an excellent opportunity for increasing the business of electric-lighting

companies, and after an inspection of various forms of lighting and types of fixtures, lamps, appliances, etc., as installed and operating under practical working conditions, the committee reported that more attention should be given to this particular type of lighting. Its observations and correspondence indicated not only lack of information, but also a desire on the part of central station men for facts regarding the latest developments in lighting units suitable for highway purposes. In the opinion of the committee, a non-uniform illumination at low intensities is more desirable for highway lighting, and it recommended that whenever possible and expedient installations include lighting units substantially in accordance with the following classifications: (A) Low-intensity illuminants, 100-cp high-efficiency tungsten lamps with refractors; (B) high-intensity illuminants approximately 300 watts with diffusing globes—(a) luminous-arc lamps, (b) high-efficiency tungsten lamps.

Discussion

Mr. H. H. Newman, Newark, N. J., opened the discussion with the suggestion that companies desiring to promote interurban highway lighting should interest men in their vicinity who have real estate to sell. The real-estate owner or dealer will quickly appreciate the advantages of electric lighting to his property, and as he is usually a man of some prominence in the community, his influence will be found valuable in securing favorable action on the part of county and municipal bodies.

Mr. W. D. A. Ryan, Schenectady, N. Y., described his investigation of a plan to illuminate a state highway from New York to Buffalo. He recommended the use of lamps of 500 cp or 300 cp mounted on 40-ft. concrete poles, and he pointed out the advantages of using some simple form of incandescent unit like the tungsten lamp which operates equally well on the alternating or direct-current service supplied by central stations along the route. Mr. Ryan also gave a graphic description of the elaborate lighting plans for the Panama-Pacific Exposition at San Francisco next year, which will use a total illumination of 2,000,000,000 cp.

Mr. G. H. Stickney, Harrison, N. J., suggested that difficulty might be introduced by making the initial lighting plans too pretentious, and he proposed that at the outset smaller units be installed, later changing these to high-powered lamps if found desirable.

Mr. T. F. Kelly, Dayton, Ohio, reported that his company has several installations of country-highway lighting, each ranging from 1 mile to 3 miles in length. The practice there has been to employ 75-watt lamps at intervals of 300 ft., an arrangement which has apparently been entirely satisfactory to the local public.

Mr. C. Thomas, New York, reported good results from the use of 70-cp series lamps installed at intervals of 110 ft., but these will shortly be replaced by 100-cp nitrogen-filled series units.

Mr. J. W. Cowles, Boston, declared that electric companies have not yet fully appreciated the income obtainable from interurban highway lighting. Rule-of-thumb methods have been used heretofore, but these must now be supplanted by scientific study of the problems involved.

Mr. A. T. Hicks, Trenton, N. J., pointed out that with the ordinary reflector much light is wasted at the sides of the highway.

Mr. Edwin Curry, Joliet, Ill., described the plans for lighting the Lincoln Highway; Mr. S. G. Rhodes, New York, referred to the use of refractors with low-intensity units and Mr. J. G. Learned, Chicago, spoke of the importance of lighting country roadways.

SOLICITING AND UTILIZATION

Greater Problems of the Electric Vehicle

In his prologue to the address by Dr. Steinmetz, Mr. W. P. Kennedy, New York, pointed out the diminishing difficulties now surrounding the introduction of electric vehicles, but insisted that central stations have been slow to perceive and take advantage of the benefits of the vehicle-charging load. He commended the manufacturers for their sustained and energetic efforts, but he urged that administrative ability of the same high order manifested in the electric-lighting and electric-railway fields be introduced into the development of the vehicle industry to concentrate upon a program of effort against which nothing can prevail.

Dr. Steinmetz on the Electric Vehicle

Before an audience which included many keenly interested standing listeners and which remained practically motionless for forty-five minutes, Dr. Steinmetz delivered a brilliant address on the electric vehicle, sketching the future possibilities to be realized by the central-station industry in this field if it seizes the opportunity now confronting it and secures control of the business of caring for this important class of service. The speaker began by drawing a close parallel between the development of the bicycle and that of the automobile. In the case of the former first came the period of initial development; next came the culmination of bicycling as a sport, followed by the decay of the latter and the readjustment of the wheel as a permanent appliance of business.

The decline of bicycling as a sport was due largely to the decreasing price of machines, and the same phenomenon will be witnessed in the automobile field. As the price goes down the exclusiveness of the sport vanishes. So long as automobiling is a sport, car owners will in many cases be willing to make their own repairs and adjustments, but as the automobile becomes more and more a business proposition these features will become more irksome. More bicycles are in use today than ever before; people of small means find the price no obstacle, and the advent of the low-priced automobile is bringing the motor car within reach of persons of very moderate income. Even this year one can see a perceptible falling off of automobile touring as a popular sport.

The steam-driven automobile has passed because it requires too much engineering ability on the part of its owner, and the gasoline car, with its many complications, cannot expect to compete with the electric automobile of the future within the field of the latter. The convenience, comfort and reliable service afforded by the electric vehicle will surely drive the gasoline car from the limited area of service required in town and suburban life. High speed will not be a requirement of the future small electric car, nor will long mileage per charge be necessary. The distances to be covered are too short for the saving in time effected by high speed to be worth while. Even the busy physician rarely exceeds 10 miles to 20 miles per day in his rounds. The electric car is superior to the gasoline car in control and is intrinsically much more reliable.

Dr. Steinmetz said that in response to the demands of the motor-vehicle user of the near future an electric automobile should be available which will cost not over $500, and which should be garaged and cared for by the central station at a cost to the owner of, say, $10 per month. This type of car will not have the luxurious fittings of many present models of electrics, its furnish-

ings corresponding more closely to those of modern low-priced gasoline cars. The speaker estimated that in ten years or less at least a million of these low-priced electric automobiles will be in service in this country, yielding an income to the central-station industry of $75,000,000 per year provided the latter seizes the opportunity now in front of it.

Charging requirements may be estimated at 1,500,000,000 kw-hr. per year, assuming that the battery of each machine received half a charge nightly. To handle this business the central station need invest no money except the moderate sum required to install suitable charging facilities, no additional generating plant being required on account of the off-peak character of the service. Dr. Steinmetz told his hearers that within ten years the electric truck is likely to produce a revenue equal to that of the light business and pleasure car. To-day the electric truck successfully competes with the gasoline truck because limited radius and high speed are not essential in the delivery business and in heavy trucking.

The Central Station's Opportunity

The speaker strongly advised the central station to take full command of the business side of caring for these new motor vehicles, pointing out that if the private garage is left to handle the business the isolated plant is sure to gain a foothold which can be dislodged only with the greatest difficulty, if at all. Better control of the operating side of battery charging can be exercised if the central station handles this service exclusively. The electric automobile of the future as described by the speaker will weigh probably not over 1000 lb.; its maximum speed need not exceed 20 miles per hour and its radius of operation per charge need not exceed 30 miles. Dr. Steinmetz said that the battery exchange system is not adapted to the general requirements of the electric automobile problem, although it doubtless meets the conditions in certain restricted local instances. Assuming that the cost of energy for charging electric vehicles does not exceed 1 cent per kw-hr., there should be a net revenue from this service of at least $60,000,000 per year. Closing, the speaker emphatically urged the central-station industry to put its house in order and get control of this immense business before it has a chance to slip into other hands.

Mr. A. Jackson Marshall, secretary of the Electric Vehicle Association of America, New York, expressed his appreciation of Dr. Steinmetz's address and assured the audience of the desire of the E. V. A. to co-operate in every possible way in the development of electric-automobile service.

"Electrical Salesman's Handbook"

The committee on the "Electrical Salesman's Handbook," of which Mr. Charles J. Russell is chairman, reported the completion of its new handbook, which has been forwarded to all members of the Commercial Section. The data is in loose-leaf form and is divided into the several topics of the salesman and his work, illumination, electric motor applications, and electric vehicles. The pocket binder provided for the convenience of salesmen is supplemented by a desk file for the storage of extra loose-leaf sheets.

In addition to the foregoing, the committee also plans to issue shortly a compilation of data on fans and blowers, a treatise on electric elevators, information on steam heating, data on motor applications, and a section on electric heating and cooking. The committee recommends that manufacturers and member companies arrange their own data sheets in page sizes conforming to the standard specifications of the publications committee.

Discussion

In complimenting the work of the handbook committee, Mr. M. S. Seelman, Brooklyn, testified to the practical value of the production and declared that to his knowledge no other similar book has been produced which can be placed with equal confidence in the hands of all classes of salesmen whether long-experienced or new to central-station sales work. Mr. Seelman urged that sales managers themselves study the handbook in addition to recommending it for use by their selling staffs.

Mr. Norman Macbeth, New York, described the method of indexing the handbook by trades, a scheme which associates subjects by similarity of applications rather than alphabetically by names. Mr. Macbeth deplored the fact that such a small percentage of the total number of central-station commercial organizations is represented in the Commercial Section. He also suggested that the subject of lighting in the home should have more extended treatment in the residence-lighting dummy.

High Load-Factor and Non-Peak Business

Two classes of business of advantage to central-station operation were discussed in the report of the committee on high load-factor and non-peak business, of which Mr. George H. Jones is chairman. The first class relates to those applications which have already been highly developed, including such lines as electric-vehicle charging, ice manufacture, etc. The second class represents industries giving great promise for the future such as electric furnaces, electrochemical processes, etc. Consumption data and actual load curves were presented for amusement parks, bakeries, breweries, brick plants, building construction, cotton mills, dairies, department stores, dredging, vehicle charging, electrochemical loads, flour mills, foundries, electric furnaces, hotels, ice plants, ice-cream manufacture, irrigation, mining, newspaper printing offices, packing houses, pumping plants, stone quarries, electric railways, etc. Descriptions were given of the plants for which data were presented, and the discussion pointed out the desirable load-factor conditions of certain of these applications. Attention was directed to the necessity for the adoption of rate schedules and policies which will enable member companies to secure a larger volume of business the character of which requires the use of electricity at times when the central station can most cheaply furnish it. In the same connection the committee brought up the question of supplying the summer lighting demand of isolated plants which require steam-heating service in winter time. Such short-term contracts seem desirable from the standpoints of both central station and private plant, but against the obvious advantages there must be considered the effects such a policy will have upon other customers of the company, first, in making admission that the central-station company cannot operate economically in buildings where steam is required for heating, and, second, in suggesting to the owners of large installations now using central-station service exclusively that they start up their own plants in the winter months and use exhaust steam for heating.

Discussion

Mr. R. M. Stephenson, Brooklyn, N. Y., said that while it is desirable to shut down isolated plants even during the summer months, there is an objection to this plan in the fact that the central station thus goes on record as admitting that it is cheaper for the customer to operate his private plant during the winter months than to purchase central-station service. Even present central-station customers might conceivably take a suggestion from such an arrangement and similarly start operation of their own private plants in the winter time.

Mr. R. D. Donaldson, Philadelphia, Pa., said that 80 per cent of the power required to drive stone-crushing plants is consumed in turning over the crusher plant itself. It has been his experience that these installations are often fed with rock at only a fraction of their rate of possible output, and he reported that by increasing the speed he has been able to decrease the energy consumption from 0.81 kw-hr. per ton down to 0.45 kw-hr. per ton of rock handled.

Mr. H. H. Holding, Newark, N. J., said that, unfortunately, there generally does not exist enough off-peak business to fill completely the valley of the central-station load-curve. He also questioned whether it would be possible to get manufacturers to change their schedules of operation in order to accommodate the central station with off-peak demand even at advantageous rates for this off-peak service.

Mr. A. C. Smith, Buffalo, N. Y., described the successful use of a new type of Snyder electric furnace which has recently been installed in his city. The demand of this equipment is from 450 kw to 750 kw and its operation comes at such a time that the night "valley" of the load-curve is well filled.

Mr. M. O. Dellplain, Syracuse, N. Y., said that the present tendency toward increased industrial unit efficiency means longer hours for the use of capital as well as shorter hours for labor. Night labor has been generally found inefficient owing to its inferior supervision, lowered vitality due to lack of refreshing sleep, and the effect of dark surroundings. Long-hour operation of industrial processes can be attained, however, by so dividing the working periods into two or more shifts that each set of men will have a part of the night for sleep and a part of the day for work. Such a scheme has been employed successfully in one plant mentioned by Mr. Dellplain, where the capital investment is being operated sixteen to eighteen hours a day, although the men have their shift schedules so arranged that no set is required to sleep wholly by day or to work wholly by night. The speaker proposed that the matter of thus revising working-hour schedules be actively encouraged by central station since in industrial communities it will have the effect of greatly improving the load-factor, due to the off-peak demands for electric motor drive, street-railway service, lighting, cooking, etc.

Mr. J. C. Parker, Rochester, N. Y., described the derivation of a "load-duration" curve, the ordinates of which are marked in kilowatts of demand, while the abscissas represent the number of hours in the year. Such a load-duration curve reveals the fact that while certain classes of business may have excellent load-factors their benefits are completely offset by other demands, which are used for only short periods daily. One-third of the investment of the Rochester company, said Mr. Parker, is worked less than an hour and a half daily. The carrying of this extra peak-load equipment involves a heavy investment charge which must indirectly be paid by the customers.

Mr. R. H. Knowlton, Philadelphia, Pa., declared that the sooner the central station recognizes and announces that there are certain classes of business which it cannot handle to advantage, the sooner will full public confidence be established in its other claims. He suggested a plan of operation by which customers would be discounted for service consumed between March and November, while another discount would be given to those who avoid coming onto the lines during the peak hours of winter days.

Mr. C. F. Pullen, East St. Louis, Ill., said that his company has been successful in getting the business of an isolated plant by omitting the stand-by charge in return for the service rendered by the private plant in starting up and helping to carry the load during winter peaks.

Mr. L. H. Scherck, Poughkeepsie, N. Y., declared that rates are closely related to the subject of getting off-peak business.

Mr. R. H. Tillman, Baltimore, said that local office building plants have found that they could save money during the summer months by purchasing central-station service at its regular rates. At the end of the six-month trial period, however, the customer usually finds it hard to return to the operation of his own plant and a permanent user is thus generally secured for the central station.

Mr. J. W. Ruff, Charleston, S. C., said that the cottonseed-oil mill is one of the desirable long-hour loads from which central stations in the South benefit. Fertilizer factories are operated chiefly during the winter months and thus tend to improve the load-factor.

In closing the discussion Chairman George H. Jones suggested the need of an entire session of the Commercial Section to be devoted to motor-application topics. In reply to an inquiry concerning the relative use of raw water and distilled water in ice plants operated by electric motors, Mr. Jones said that of the seven Buffalo electrically operated ice factories three use the distilled-water system and four make ice from raw water. Of the fifteen Chicago plants thirteen are of the raw-water type and two use distilled water. All of the Brooklyn plants utilize raw water. Energy for ice making is sold in Chicago at a rate of about 1 cent per kw-hour, the customer guaranteeing a minimum load-factor of 65 per cent. Service is supplied under the Commonwealth Edison Company's standard schedule by the terms of which through long-hour operation these ice factories may earn rates as low as 0.87 cents per kw-hour.

Wiring Existing Buildings

The committee on wiring of existing buildings, of which Mr. R. S. Hale, of Boston, is chairman, found on investigation that there is a great deal of business yet remaining to be done in wiring old buildings. At the present time electrical growth is attributable to new buildings, and except in cases of special campaigns only a very small proportion of the possible number of old buildings is being wired yearly. The committee recommends that companies should encourage their solicitors to seek this business and point out that by means of unit prices per outlet contracts may be closed on behalf of the wiring contractor without waiting for a special estimate in each case. Such a plan is already in use in many cities. The article on the successful handling of the small consumer in Europe by Mr. S. E. Doane, published in the *Electrical World* May 23, 1914, forms Part II of the report. Referring to the question of the standardization of plugs and receptacles, the committee points out that the Underwriters are as yet unwilling to take any action, even though their present rules actually have the effect of encouraging the connection of heating devices to lamp sockets when the use of receptacles would be very much better. Because of patents covering plugs and receptacles, the committee has not been able to make progress with the manufacturers looking to the standardization of these devices, and it recommends that its work in this direction be continued. Being asked by a committee of the Commercial Gas Association to take steps toward a standard specification for combination gas and electric fixtures, the committee decided that such specification, except in so far as it is included in the National Electrical Code, would not be desirable.

Discussion

In opening the discussion on the report by Chairman

Hale and the paper by Mr. Doane, Mr. T. I. Jones said that heretofore central-station customers returning less than one dollar per month have been considered undesirable since the cost of reading meters, billing, sending out cut-off men, etc., has been found to average from $1 to $1.50 per month per customer. The solution, however, lies in simplifying billing methods and in the use of an inexpensive current-limiting device by which the cost of the meter and of reading the meter will be eliminated. He suggested a plan by which seashore residents might pay for their lighting in advance for the season at the rate of, say,, $1.50 per month. By installing a flat-rate controller the central station would incur an investment charge of only $2 or so, and would require no further attention to the customer after connecting up his premises.

Mr. E. W. Lloyd, Chicago, declared that the present tendency of the Underwriters will put a limit on the use of electricity by small customers if their practice in requiring expensive construction is continued.

Mr. W. M. Kerr, New York, said that if public-utility companies are to perform their full duty to their communities they must devise some means of reaching the large class of small consumers. This is a social obligation, and next to it service to the small customer has a political significance as well.

Mr. J. E. Latta, Chicago, explained the relation of the Underwriters and the Underwriters' Laboratories to the National Electrical Code. The Code is formulated by a committee on which the N. E. L. A. and other electrical organizations have representation. The Underwriters, he said, desire to encourage the most general use of electricity and entertain no desire to make the cost of electrical construction excessive.

Mr. W. A. Donkin, Pittsburgh, Pa., said that his company now has 3000 flat-rate customers on a controlled basis, the minimum contract taken being for four 25-watt lamps at the rate of $1 per month. Several months ago when the company had only 2600 flat-rate customers an investigation showed that this class of business was then returning $60,000 annually.

Mr. J. C. Weismandel, Brooklyn, N. Y., described the installation bureau of his company. Salesmen are paid on the double basis of salary and commission and are thus encouraged to work among prospective customers at night, on holidays, and at other times when the "prospects" are most easily reached.

Mr. P. H. Kemble, Cincinnati, Ohio, said that of a given number of controlled flat-rate customers at least 30 per cent will soon demand meters, thus becoming permanent and useful users of the company's service.

Mr. L. R. Wallis, Boston, Mass., described his unit wiring offer which has resulted in the wiring of 769 old houses. Under this scheme $14 is charged for the first outlet and the average cost for installation has ranged between $67 and $92.

Mr. R. W. Hoy, Harrisburg, Pa., said that after customers on a controlled flat-rate basis have begun to replace a few burned-out lamps, they soon revise their former plan of burning lamps at all times whether needed or not. About 25 per cent of his flat-rate consumers, he added, have already changed to metered service in order to obtain the enlarged advantages of electric service.

Mr. H. R. Sargent, Schenectady, N. Y., declared that the systems of wiring used abroad would never be approved in this country, although he expressed confidence that a satisfactory form of construction might be devised for use here. The passage of a rule requiring rigid conduit in all cities, as is expected at the next meeting of the code committee, will greatly militate against the use of service by small consumers, he declared.

Mr. T. I. Jones recommended that the manufacturers submit their devices for the comments and suggestions of central-station sales departments before offering them on the market, as many unobserved drawbacks could thus be eliminated before the device reached the customer's hands. Mr. R. R. Young, Newark, N. J., proposed that heating-appliance receptacles be mounted in the wall at a height of about three feet above the floor instead of in the baseboard, following the present general practice which causes tired backs and broken cords.

Mr. A. W. Young, Camden, N. J., described his plan of wiring kitchens and dining rooms on separate circuits of No. 10 copper for the use of heating appliances, while all the other fixtures in the house are served by standard No. 14 size wire. Mr. J. S. Swallow, New York, told of the great number of trouble calls received due to faulty sockets. Mr. W. D. Hodgson, Glens Falls, N. Y., said that tenants moving from house to house often find difficulty in using their electrical appliances in the different receptacles encountered.

Electrical Merchandising and Advertising

The report of the committee on electrical merchandising and advertising, of which Mr. Parker H. Kemble is chairman, described and outlined methods of successful electrical merchandising, the organization and management of commercial departments, store planning, systems of appliance records, methods of purchasing appliances, etc. The sale of appliances by central stations at a fair profit was recommended as a uniform policy, although there was pointed out the necessity of maintaining the co-operation of local electrical contractors and merchants.

Another section was devoted to examples of advertising which contributed to successful appliance sales and campaigns. Order forms were reproduced in detail, and a bibliography of advertising literature of interest to the manager who is required to write his own advertising "copy" was also added.

The report closed with brief notes on the training and handling of a sales force and an enumeration of advertising principles. In the discussion of sales methods particular emphasis was laid on the relations between the sales manager and his men. The manager must be fair and square, it was insisted, and should bestow words of encouragement whenever an occasion can be found. By such simple methods of appreciation the men will be stimulated to the greatest interest and enthusiasm. The language used in talks on salesmanship must be not only simple but on a plane easily understood by the listeners.

Discussion

In discussing methods of selling appliances, Mr. L. D. Gibbs, Boston, urged simplification so far as possible. Trained men, he said, are not required to sell electric irons or the simpler cooking devices. The central station company should endeavor to keep in close touch with its customers.

Mr. F. D. Pembleton, Newark, N. J., declared for a maintained schedule of appliance prices in order that dealers and contractors might share in the sales and so stimulate customers' interest in electrical development.

Mr. J. G. Learned, Chicago, said that through the eighteen salesrooms of his company, which serves a total population of 50,000 people, there have been sold during the year nearly 8000 appliances, including 285 vacuum cleaners, 296 washing machines, 3462 irons, 2316 toasters, and 1489 toaster stoves.

Mr. M. Hart, Chicago, pointed out the beneficial results gained by the company from the policy of instil-

ling in the customer's mind the company's desire to render him service and its interest in seeing that he is satisfied.

Mr. H. H. Newman, Passaic, N. J., recommended that the sales manager show interest in his men and encourage them in their successes and in their failures.

Mr. P. S. Dodd, New York, made a plea for popular advertising of the advantages of electricity in the national magazines, and urged N. E. L. A. members to become subscribers to the Society for Electrical Development and to aid in its forthcoming campaign to interest the public in things electrical the country over.

METERS AND MEASUREMENTS

Report of Committee on Meters

The committee on meters, through its chairman, Mr. P. H. Bartlett, of Philadelphia, presented a 140-page report covering the subject in both technical and legislative branches. A chart is included showing the gist of the meter regulations of many states and an appendix of forty-eight pages devoted to extracts from public utility laws and regulations pertaining to meters. A detailed description was given of the new General Electric type I-14 induction meter, and reference is made to the favorable outlook of the new mercury type watt-hour meter for direct-current service. Owing to standardization of various types of meters costs are tending somewhat lower. Tests are being conducted under the auspices of the committee upon ampere-hour meters of small sizes for direct-current service. The report also includes an illustrated method of making break-down tests upon induction meters, the results of accuracy tests upon 100 old-type direct-current meters, and a discussion of the proposed standardization of transformer, instrument and meter connections, and of shunts. Space was also given to the classification of maximum-demand services, in which great interest is being shown, and brief descriptions were included in the report of recent improvements in meters of Sangamo, Esterline, General Electric, Westinghouse, Ingalls and other designs. The committee welcomes suggestions regarding the advisability of printing future editions of the "Metermen's Handbook" in loose-leaf form. The "Code for Electricity Meters" was not printed in the 1913 proceedings of the association, but can be obtained at the office of the secretary.

Discussion

Mr. J. C. Parker, Rochester, N. Y., called attention to the local disrepute into which operating companies are liable to fall on account of the conflicting rulings of state commissions, in cases where the service exists in more than one state. He suggested the possibility of obtaining help from the committee where adverse legislation is proposed. Mr. G. A. Sawin, Newark, N. J., cited the importance of giving meters proper care. Tests on a number of old induction meters receiving no care showed them to be 15 per cent slow; similar meters with reasonable attention were only 5 per cent slow, while modern induction meters maintained with the greatest care were only 1 per cent or 2 per cent slow. Other speakers were Messrs. F. G. Vaughen, Schenectady, N. Y.; O. J. Bushnell, Chicago; E. F. McCabe, Titusville, Pa.; S. J. Lisberger, San Francisco, Cal., and E. C. Stone, Pittsburgh, Pa. The point was made that it would be helpful to manufacturers if operating companies would be as definite as possible in specifying the time intervals required in demand indicators, and the importance of integrating the load throughout a period long enough to give an idea of the heating conditions was emphasized.

International Measurements and Values

A brief outline of the events leading up to the adoption of an international standard of electrical conductivity for copper was given in the report of the committee on international measurements and values, of which Dr. A. E. Kennelly was chairman. A resistance of 1/58 ohm was adopted for standard annealed copper wire 1 m long and 1 sq. mm in cross-section at 20 deg. C. This value differs only very slightly from the value previously used in England, France, Germany and the United States. The international standard of resistance for standard annealed and commercial copper was appended to the report.

ACCOUNTING METHODS

Accounting Library

The sub-committee on the accounting library, of which Mr. C. L. Campbell is chairman, reported that 7380 new forms from 127 companies have been collected and filed according to the size of the city and the topic of the form. Companies were requested to assist in keeping these files up to date by advising the library of any changes in their forms. The annual reports of

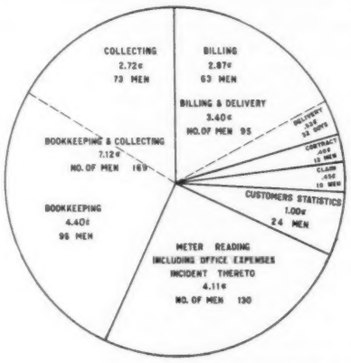


FIG. 6—COST PER BILL RENDERED, COMMONWEALTH EDISON COMPANY

various State commissions have been added to the files, and accounting systems prescribed by State commissions are being collected.

Accounting Question Box

Mr. E. C. Scobell, Rochester, N. Y., presented a resolution made by the Question Box sub-committee favoring the employment of a man to act as secretary to the chairman of the accounting committee, in gathering statistics on forms, keeping files thereof and indexing and tabulating questions and answers.

Discussion

Mr. J. C. Van Duyne, Brooklyn, N. Y., explained the operation of the Brooklyn Edison Company's auditing department council. This council makes it a point at each meeting to discuss questions published in the monthly bulletin and transmit answers thereto to the editor of the bulletin.

Cost and Statistics

The enormous size and increased complexity of metropolitan central-station companies necessitate careful watching of expenses. To this end, as described by Mr. Thomas J. Walsh, the Commonwealth Edison Company has a budget and expense committee, whose duty it is to study and pass on investment budget work and

operating expenses. The Chicago company has adopted the standard classification recommended by the National Electric Light Association and has subdivided the accounts to fit its requirements, thus enabling a comprehensive and intelligent analysis to be made of the expenses of the various departments. After the different accounts have been computed on an appropriate unit basis, the results, in the form of both data and statistics, are plotted and typewritten on sheets which show a comparison between the money spent by the departments each month and that for the previous month and also for the corresponding month of the year before. An example of the method of analysis was shown in the chart reproduced on page 1322, analyzing the cost of each bill rendered in Chicago. More than 200,000 bills are there rendered monthly at a total cost of $403,960, or 16.5 cents per bill.

In commenting on the depreciation of electric vehicles Mr. Walsh said that the Commonwealth Edison Company assumes a life of ten years. He believes this life is too low, as there is nothing to depreciate in an electric vehicle except the body.

Discussion

Mr. H. White, Brooklyn, N. Y., spoke of a monthly report in which the total cost of production in the generating stations is subdivided into labor and material expenses and reduced to a kilowatt-hour basis. The report is submitted to the vice-president of the company, who can tell at a glance where economies can be effected. A similar report is made of the substation expenses.

Mr. Peter Junkersfeld, Chicago, Ill., said that the Commonwealth Edison Company reduces its expenses to different unit bases, depending on the department to which the report refers. In some instances a reduction to a kilowatt-hour basis is used, in others, the customer or meter basis is necessary. On line work the reduction may be per mile of wire strung or per pole set. He emphasized the importance of developing accounting methods to give cost-keeping data.

Mr. H. A. Givney, Boston, Mass., expressed the belief that too many companies prepare statistics that are never used, and suggested that the statistics be condensed to minimize the expenses of compilation.

Mr. A. L. Holme, New York, described reports submitted to superintendents of different departments informing them of supply costs charged to their respective departments. The report is compiled from records of supply deliveries, direct purchases and work orders by jobs. He added that the auditing department learns considerable as to the proper classification of accounts by submitting these reports to the superintendents and receiving arguments when the charges are not assessed to the correct department.

Messrs. Homer Niesz, Chicago, Ill., and Herman Spoehrer, St. Louis, Mo., said that expense reports are invaluable in apportioning budgets.

Classification of Construction and Operating Accounts

In a seventy-page report constituting a working handbook of expense classification the committee on classification of accounts, of which Mr. John L. Bailey is chairman, analyzed the principal items of outlay associated with the construction and operation of a modern electric-service system. Detailed lists were given of the items involved in organization, franchise-getting, physical-plant construction, liabilities, assets, income accounts, production, transmission, distribution, utilization, commercial, new business and general expenses and appropriations. Full explanations were given under each account heading as to its inclusiveness, and the subdivisions were carried to a degree of unusual completeness. A few commentary notes were included in the report. One of these emphasized the opposing practices of the New York and Wisconsin commissions with regard to allowing the capitalization of discount on bonds, the former prohibiting and the latter permitting it. The committee is of the opinion that where it is not permitted to capitalize the discount on bonds and the expense of their issue this cost should be charged to an account called "debt discount and expense."' In this event it is proper to amortize the cost at a proportional rate based upon the life of the security to maturity. In another note it was pointed out that the committee does not approve of the New York commission's distinction between meters in the storeroom and those connected on the consumers' premises, contending that it should not be necessary to make a financial entry every time a meter goes out. If it is the policy of the company to capitalize the cost of setting meters, this cost should be charged to the consumer's installation. Under the heading "Maintenance of Underground Conduits," the committee held that this cost, including both patrolling and inspecting of underground conduits and subways which carry both transmission and distribution conductors, should be apportioned between this and the account provided for transmission underground-conduit repairs. In the scope of items included and the care with which their separation is affected the report is unusually clear and practicable as a working document.

Discussion

Mr. H. M. Edwards, New York, impressed upon the delegates that the classification of accounts when issued must go out as the expression of opinion of the entire electrical industry. As state commissions are awaiting the appearance of the uniform system of accounts, it is particularly important that the classifications should represent accepted practice.

Mr. Frederick Schmitt, New York, expressed the belief that sub-investment accounts should be kept in a separate ledger from the main or balance-sheet accounts.

Mr. H. A. Givney, Boston, believed that hydraulic generating station acounts are entirely too elaborate for small plants. He pointed out that if the classification of accounts were adopted as printed the smaller plants would be required to go to an expense in compilation not warranted by their business. He also suggested appending a description of the method used in classifying the accounts in order that state commissions can obtain a better idea regarding them without studying the details.

Mr. C. L. Campbell, Waterbury, Conn., made a motion, which was passed, that all suggestions made during the discussion referring to the text and not the principles of the classification should be referred directly to the committee. According to the printed classification, poles, fixtures and conduits are not classified separately under transmission and distribution, as this equipment generally serves for both purposes. If the state commissions prescribe a subdivision, Mr. Campbell said that the individual companies can revise the classification to accomplish this result. He suggested further that installation of customers' meters should be charged to construction and not operating expenses.

Mr. Franklin Heydecke, Newark, N. J., informed the delegates that the New Jersey commission makes it optional with the electric-service companies whether the meter-setting should be charged to operating or construction expenses.

Messrs. Givney, Bailey and Campbell expressed themselves as believing that the first installation is a capital account and succeeding installations should be charged to operating expenses.

Mr. Edwards declared that, as some companies prefer to capitalize this expense and others favor carrying it as an operating expense, no set rule should be prescribed for the classification of this account.

Mr. A. L. Holme called attention to the increased labor required in capitalizing expenses and advised handling as many expenses as possible as operating expenses.

Another subject receiving considerable attention was the classification of uncollectible bills.

Mr. Campbell advised marking off uncollectible bills on gross revenue receipts in order that the account may show the actual cash received.

Mr. Walsh said that as the Commonwealth Edison Company must give a certain portion of its revenue to the city, it seemed just that uncollectible bills be deducted from the earnings as indicated in the income account.

Mr. E. C. Scobell, Rochester, N. Y., named several state commissions treating this acount as an operating expense and others prescribing that it be deducted from the income account.

Mr. Edwards called attention to the fact that in all branches of life the debts of the insolvent man must be offset by increased contributions from the prosperous men; therefore uncollectible bills should be treated as an operating expense and not as a deduction from revenue.

The opinion of the meeting on this subject was finally expressed in favor of carrying the account as an operating expense.

While the printed classification of hydraulic generating accounts is rather elaborate, the subdivisions were considered necessary by California companies, as former classifications did not meet their needs.

Mr. Givney said that as contributions for charitable purposes are usually made because the companies consider it good policy and not out of goodness of heart, this account should be charged to operating expenses and should not be deducted from the surplus.

Mr. A. S. Ives, New York, suggested that the dividing line between distribution and service lines should be more clearly defined to facilitate accounting.

In answer to a question raised by Mr. Payne, Boston, Mr. Edwards said that in combined electric and railway stations accounts which are common to both utilities can be classified together and individual accounts should be listed separately.

Mr. C. E. Calder, Wichita Falls, Tex., suggested that accounts relating solely to municipal lighting equipment should be separated from other accounts.

Mr. D. C. Jackson, Boston, said that if a division is to be made between the cost of producing energy for municipal service and other service, it should be done thoroughly or not at all.

Mr. Campbell declared that it is difficult, if not impossible, to separate municipal lighting costs from other production expenses. He also stated that it is very important that the accounting committee express itself as to the proper classification of accounts regardless of commission rulings. Where there is a conflict with commission rulings, a note should be added to that effect.

Mr. C. M. Cohn, Baltimore, Md., expressed the belief that the classified accounts drawn up by the accounting committee should harmonize with those of other associations. He therefore made a motion, which was passed, that the N. E. L. A. accounting committee confer with like committees of the American Electric Railway Association, the American Gas Institute and the National District Heating Association for the purpose of harmonizing the classifications as much as possible.

Prof. Jackson on Appraisals

In his rather intricate paper on "Appraisals of Electric Light and Power Properties" Prof. D. C. Jackson confined his remarks to plants established under fixed or indeterminate franchises. The speaker called attention to important differences in the operation of public service companies and the ordinary businesses with which the general public has become familiar through experience.

The interest on investment in a public utility property is a much larger part of the total revenue than in a mercantile business. Instead of earning a gross annual revenue equal to or exceeding the capital investment, a public service company ordinarily expends a sum of money in establishing its plant and business which is not less than four or five times, and in some cases as much as twelve times, the gross annual revenue that it may expect to receive. This at once multiplies the proportion of the revenue which must go to the investors in case a reasonable return is paid on the investment.

Competition does not introduce any inconvenience in the relations between customer and purveyor in ordinary business, nor is expensive duplication of capital caused by competition where the fixed capital is small. Inconvenience to the customers is often caused, however, where general competition of like public service companies occurs, and duplication of capital is likely to be large and economically indefensible in the case of competing public service companies which give like service.

Electric utilities might gain greater strength with the public, thereby improving their stability, by making annual investment and earnings statements of studied definiteness and completeness whether required to do so by public service commissions or not, and the publication of these statements in the daily newspapers, after the manner of the publication of bank statements, would bring matters before the public mind in a way that no other process can rival.

To bring about the needed confidence between the public and the companies without friction and shock it is of importance that engineering statistics be made more a part of the permanent records of the companies and that the record keeping of the companies become a joint structure of accountants' financial statistics and engineers' physical and production statistics.

Discussion

With the advent of public utility regulation, Mr. W. W. Freeman, Cincinnati, Ohio, said there was a demand for good accounting. The adjustment of rates has further required that the real value of the property regulated be determined by appraisals. The speaker also emphasized that the public should be made to understand that demands for improvements must necessarily be met by increased revenue and consequently higher rates. By requiring detailed accounts of plant expenses the operating expenses of the company will be increased and the public will eventually have to foot the bills. Mr. Freeman added that appraisals will demonstrate that reasonable rates are being charged in most cases.

Mr. Harold Almert, Chicago, called attention to federal activities at Washington which may affect the entire country. The federal commission which is appointed by Congress to regulate the utilities of the District of Columbia has expressed itself in favor of government ownership of all utilities in that district. It is possible that other commissions in the United States may copy any action taken by the commission of the District of Columbia.

Difference Between Accounting Systems

Mr. E. C. Scobell, Rochester, N. Y., read a paper on "Variations in Public Service Systems of Accounting," in which classifications of accounts from several states were compared mainly as to their differences. Plant and equipment accounts differed considerably in the cases considered, but floating capital accounts corresponded more closely as there is less chance for divergence of opinion as to the classification of those items. Attention was called to the provisions in some of these systems for amortization of intangible capital which would be well to follow in the N. E. L. A. classification. Other accounts not included in the association's system were also mentioned. Taxes, uncollectible bills and rentals, which have been the subject of considerable dispute, were classified as operating charges in some states and as income deductions in others. As an appendix to his paper Mr. Scobell presented a tabulated list of accounts investigated. To afford members of the N. E. L. A. an opportunity to study this comparative list of accounts at any time it will be filed in the accounting library.

Replacements, Renewals and Depreciation

Suggestions by the public policy committee for the classification of renewal, replacement and depreciation charges were presented by Mr. H. M. Edwards, chairman of the accounting committee. This matter was investigated by the public policy committee because the classification of these items involved a financial rather than accounting principles. Considerable data were collected in preparing the report, which showed a wide divergence of opinion as to the proper location of these accounts. The committee recommended that the executive committee authorize the accounting committee to refer to these subjects in its standard classification as follows:

Reserve should be created by means of a contemporaneous charge to operating expenses to provide funds to defray the cost of: (a) Necessary renewals and replacements of property retired from service due to normal causes or to obsolescence and inadequacy, the result of advances in the state of the art, improvements in efficiencies, etc. (b) Casualties caused by fire, flood, earthquake, insurrection, riot or any other disaster not covered by insurance and for contingencies.

The average annual cost of renewals and replacements of property should be based on as many years of actual experience as possible. The reserve necessary for uninsured casualties and contingencies must be determined by each company.

The amount of the reserve should not necessarily lie idle in the banks nor should its use be limited to outside investments, but on the contrary should preferably be invested in the property when required. If needed for the purposes of extensions of the business, it should be available.

The raising of additional capital can thus be deferred until such time as the renewal is required for which the reserve was created, when the cash from the new securities can be applied to restore the fund previously invested in new property.

The report recommends that the words "depreciation" and "amortization" should not be used in connection with the accounting systems of public utilities. Renewal and contingent expenses should be classified in a sub-account under the general head operating expenses, general and miscellaneous. To this account should be charged at monthly intervals the monthly proportion of the average annual cost of renewals and replacements of tangible property, and the amount estimated to be necessary to provide a reserve to cover the cost of extraordinary casualties and contingencies. The amount so charged should be concurrently credited to the reserve account, "renewal and contingency."

Renewal and contingency reserve should be classified in a sub-account under the general head "Liabilities, operating reserves." To this account should be credited such amounts as are charged from time to time to "renewal and contingent expense" to provide for the renewal of tangible property at the expiration of its useful life, and a reserve to meet the cost of uninsured casualties and contingencies. When property is retired from service the original cost thereof should be credited to the property account interested, and the said amount less salvage concurrently charged to this average annual cost of renewals and replacements, together with the accruals, if any, thereof; the excess may be temporarily charged to the suspense account entitled "abandoned property" and carried therein until such time as it may be conveniently absorbed by the average annual provision for this purpose.

Discussion

Mr. J. W. Lieb, Jr., New York, chairman of the public policy sub-committee on depreciation, which had direct charge of making this report, said that the subject of the report ranks in importance with that of rates and value of property. Even small companies must consider the subject of depreciation, for all regulatory bodies include it in prescribing a fair return on investment.

Mr. H. A. Givney, Boston, said that as the New Hampshire commission will soon give a hearing on the subject of depreciation it would be advisable to submit to them a copy of the report.

Mr. C. L. Campbell, Waterbury, Conn., made a motion, which was adopted, that the report of the public policy committee be adopted and such portions as desired by the accounting committee be published in the unified classification of accounts.

Accounting for Merchandise Sales

In a paper by Mr. H. B. Lohmeyer was described the system of merchandise sales accounting in use for the past year by the Consolidated Gas, Electric Light & Power Company, Baltimore, Md. This system was developed on the theory that merchandising should be put on a self-sustaining basis and handled as a separate department, with its own income and expense account. Instead of keeping detailed stock cards for each item, the company carries a subsidiary stock record at selling value in totals only, in addition to the regular stockroom account (at cost) carried on the general books. The check is obtained by the following equation: Inventory at beginning of period plus net purchases during period less sales and breakages at end of period, all at selling prices, must equal inventory at end of period. The check falls within two-thirds of 1 per cent.

The author gave a detailed account of the use of stock and purchase records, with reproductions of each. The sales system is a duplicate-ticket plan similar to that in vogue in many large department stores. Eight stores are maintained by the company for the sale of appliances, and the records are departmentalized on a location basis, to ascertain the profit or loss at each store. Ample data regarding the sale of each kind of appliance are deduced by the use of tabulating machines. Every anticipated condition is provided for, including the sale of appliances carried home by the customer, the delivery of apparatus by the company, credits, transfers, instalment purchases, repairs, etc. Statements of daily sales, comparisons of the sales of individual employees on corresponding days each year and close verification of records are interesting fea-

tures. Expenses are charged under the following headings, often overlooked in electric merchandising: Salaries and commissions of salesmen, salaries of department executives, rent, heat, light, miscellaneous, clerical salaries and expense, proportion delivery department expense, and administrative expense. The net profit is carried to an account known as "Profit on Merchandise Sales" and becomes a part of the regular income account. The system has proved an economy in clerical work and a great help to salespeople and street representatives, its simplicity and directness saving a great deal of time formerly required in making out several different kinds of tickets.

Discussion

Among those discussing the paper were C. E. Calder, Wichita Falls, Tex.; C. R. Price, New Bedford, Mass.; E. J. Allegaert, Newark, N. J.; Herman Spoehrer, St. Louis, Mo.; T. W. Flower, Brooklyn, N. Y.; Franklyn Heydecke, Newark, N. J.

Mr. Lohmeyer in closing the discussion answered questions brought up by these delegates. Some of the points brought out follow:

The gross profit on sales is estimated each month from the selling price and cost, and every six months the books are closed in the customary manner. When computing the expense of conducting the merchandizing department an administrative expense is apportioned. A check on the selling price is secured by passing all sales slips and packages through the delivery department. If articles are sold at a reduced or raised price, "loss" or "mark-up" tickets are filed with the respective sales tickets. All expenses of conducting the merchandizing department are deducted from the gross profit on merchandise sales and not charged to operating expense. All goods are sold at catalog prices.

Suspense Accounts

In a paper by Mr. Frederick Schmitt it was stated that suspense accounts are of two general classes—first, those rightly classified as suspense on account of having uncertain elements, and, second, those commonly representing costs of a definite character, which properly should be called clearance or apportionment accounts. The author described various components of each class, including under the suspense account general suspense and accounts receivable suspense, and under clearance accounts work in progress, storeroom expense, transportation expense, deferred and miscellaneous charges. Under general suspense it is customary in some companies to include cash advanced to employees for expenses to be accounted for later, also cash withheld from wages to satisfy judgments filed against employees. The author held that in dealing with bad debts, whenever doubtful accounts are transferred from current assets to a suspense account which still appears on the books as a contingent asset, a corresponding reserve account should be created by charging operating expenses with an amount sufficient to cover those accounts found irredeemable. By this method the accounts are left on the books at their face value, yet are carried on the balance sheet at not more than their probable worth. The New York Edison Company follows this general plan.

The author also emphasized the value of a work-order system. He discussed storeroom expense at some length, favoring the clearing of such accounts on a constant or percentage basis added to each requisition for material and criticising the elaboration required in such accounting by the Public Service Commission, First District, New York, in the case of companies using the clearing method. Experience shows that the cost of handling supplies bears a definite relation to their value, and that by an occasional adjustment, practice is more satisfactory than where a minute subdivision is attempted, involving such difficulties as the proportional cost of storage of each kind of supply carried, prorating shelving and counter space, building repairs, etc. The author did not look upon cash discounts recovered through prompt payment as a saving or revenue, but held that supplies should be charged at the full price, charging the discount when not taken to profit and loss. Apportionment of transportation costs should be on a rate per hour for the time of use of each vehicle, the actual sum paid being used for vehicles not owned by the company. Discount on bonds is not held to be a part of the cost of acquiring a property, being a virtual interest charge.

Discussion

Mr. A. L. Holme, New York, spoke of the difficulties encountered in apportioning overhead charges if a certain percentage of storeroom expense is not apportioned on each article as it is issued.

Mr. Heydecke advised setting up a monthly reserve to wipe out uncollectible bills. This reserve, he suggested, might be based on a certain percentage of the monthly earnings.

Mr. J. C. VanDuyne, Brooklyn, N. Y., believed that as the amount of uncollectible bills is usually negligible (not more than 0.2 to 0.5 per cent of the earnings) it is not necessary to carry such a reserve.

Mr. Edwards explained the system of mutual insurance carried by New York electric service companies. In comparison with old-line insurance company rates, which may be as high as 15 per cent of the payroll, the mutual insurance rates are only 1 per cent. The success of the mutual insurance scheme is ascribed to the care in inspecting plants and establishing safety-first methods. In Boston, where mutual insurance methods have been perfected to a greater extent, the rates are only 0.25 per cent of the payroll.

Mr. J. L. Bailey, Baltimore, declared that an extremely low rate of 20 cents on $100 exists in Baltimore.

Disbursement Accounts

In an extended paper by Mr. F. A. Birch describing the system used in accounting for purchases by the Philadelphia Electric Company, the advantages of the Hollerith method of tabulation were illustrated and a detailed account was given of the handling of each form designed for purchasing and the distribution of charges to the classification expense accounts. The company receives about 6000 purchase invoices each month, covering supplies bought for construction and operation. With the old-style voucher-register system monthly reports were not completed before the twentieth of the month following the expenditure, at the earliest, but with the use of tabulating machines a saving of from a week to ten days is attained. The forms used are comprehensive and clear-cut, and the author set forth their interdepartmental routing with great precision. A special voucher case has been developed for use where a disbursement is not supported by a purchase invoice. No check book is required in using the voucher check. Verification of bill totals in the tabulating machine is a valuable feature, and instead of keeping details of operating expenses, construction charges and other accounts affected by accounts payable in the voucher register, this information is obtained from the tabulating cards.

The time required to run the accounts-payable cards through the tabulating machine for any month is less by several days than the time formerly needed to add the 140 columns on each of the twenty pages of the

voucher register. It is now a matter of but a few moments to assemble and tabulate the vouchers and so obtain complete analysis of any account. The tabulating machines greatly expedite posting to general and auxiliary ledgers and the classification of data desired by public service commissions, boards of directors and executive officers. An example of the detail available from machine cards was given under the handling of customers' deposits. Cards may be sorted to show the amount of guaranteed deposits in different sections of the city, the amounts of deposits received from various classes of business, the denominations of money in which they are received, number of deposits transferred, average length of time a deposit is held, amount of interest allowed on deposits, refunds and many other points. The slight disadvantage of the longer time required to analyze a single account with the tabulating machine as compared with the former method of entering each separate item, with an attached explanation, in a book is offset by the great saving in time required to itemize all of the accounts in books, when particulars regarding only a few are needed and when very probably none will be asked for. It is contrary to the principles of scientific management to prepare a maximum amount of data for hundreds of items when details will be requested for only a very few, and the tabulating machine method is admirably flexible in this connection.

Sorting and Tabulating Machines

In a paper by Messrs. G. L. Knight and C. V. Woolsey was described the use of sorting and tabulating machines on the distribution system of the Edison Electric Illuminating Company of Brooklyn, N. Y., pointing out the adaptation of code numbers to the classification of material and equipment in transmission and distribution and giving in detail code data applicable to inventories. It was pointed out that the use of code numbers greatly simplifies the taking of an inventory, even in cases where a tabulating machine is not considered, saving time and reducing the chances of errors in making transfers. The code is designed to indicate only such characteristics of the material as are required to estimate its unit value in reports of physical property. The code is greatly simplified by using a code number consistent with the material represented. Thus, the code number for a twelve-duct subway consisting of fiber conduit laid two ducts wide and six ducts high in the trench would be 1212. The first two figures (12) indicate the number of ducts in the trench, the third figure (1) represents the kind of conduit (fiber), and the last figure (2) shows the number of ducts width. Examples are given of the use of tabulating cards, summaries and other inventory data in a central-station office in which a complete statistical unit consists of two key punches, a gang punch, with quick-set device, sorter, tabulator and card files. The paper forms a working manual within its field and scope of the code submitted, and the clearness of the illustrations entitles it to be classed as a small handbook for the accounting force interested in the economical handling of both original and periodical transmission and distribution system inventories.

Discussion

In speaking of the economy of employing mechanical tabulation Mr. Birch said that the total cost of getting out 1000 vouchers per month for a system serving 60,000 consumers was about $10,000 a year.

Mr. G. L. Knight, Brooklyn, N. Y., called attention to the fact that a continuous inventory can be kept by a single clerk if forms adapted to use on mechanical tabulators are employed with that system of tabulation.

Purchasing, Storing and Accounting of Coal

The methods employed by one of the New York electric-service companies in the purchase and delivery of its coal were described in the paper on "Purchasing, Storing and Accounting of Coal for the New York Edison Company," by Mr. Charles L. Lehmann. The author took up in logical order the purchasing, transporting storing, testing, insurance and accounting methods. The company's coal-storage plant and lighting system, permitting of night work, were described and illustrated. Sampling and testing of coal for moisture, volatile matter, sulphur and heat content were described. Transportation and cost records were explained in detail, copies of many of the forms being shown.

The company purchases its coal by yearly contract and follows the railroad shipments to tidewater ports. Coal which is not required for immediate use is stored in a yard capable of holding 150,000 tons. At present about 900 tons of coal can be received and stored per day of nine hours, and about 3000 tons can be reloaded in the same time. Extensions are now being made to accommodate 300,000 tons, and facilities are being provided for increasing the daily unloading and reloading rate of 1800 tons and 5000 tons respectively.

MISCELLANEOUS SUBJECTS

Accident Prevention

A helpful résumé of accident prevention from the central-station standpoint was presented by the committee in charge of this subject, of which Mr. Martin J. Insull, Chicago, is chairman. The report outlined the organization of a "safety first" campaign, with practical suggestions as to method of procedure, formation of committees, education of employees, first aid and its limitations. The committee favored uniform reports of accidents, submitting a standard blank for this purpose. An interesting feature was a number of diagrams showing the causes, anatomical distribution and occupations involved in 2670 accidents reported by member companies in the past sixteen months. The more frequent causes were striking or being struck by material, handling tools, wire, glass, sharp edges, lifting or moving material, falling bodies, electric current and falls.

The latter part of the report included a list of standard danger and safety signs, printed in colors, a scenario of the motion-picture film "The Lineman," which is the property of the association and which shows careful and careless ways of working on the distribution system, a compilation of precautionary rules, and various recommendations. Among the latter were the general use by member companies of the material prepared by the committee, which represents the latest views on safety work as adapted to the electrical industry. The motion-picture film may be rented at a nominal charge, and the committee desires full cooperation in every phase of its beneficent activities from all companies and members.

Report of Publications Committee

During the ten months preceding the convention the publications committee, of which Mr. Douglass Burnett is chairman, handled 130,000 publications, bringing the total number issued by the committee during the last two years up to 350,000. Only about 13 per cent of the company membership has, however, taken advantage of the publications offered, although the number of publications covered by each order has practically doubled during the last year.

The publications of the committee are adapted to receive the imprint of the member company using them, or, if desired, the committee will furnish the inside pages, allowing the local company to arrange its own distinctive cover form. In connection with residence business, the committee will shortly issue to member companies its so-called "residence service dummy," and it is therefore urged that each member company prepare a list and send the entire set of descriptive matter to all its prospective customers. An "Electrical Salesman's Handbook" has been issued by the Commercial Section during the year, and the publications committee is at present making an active effort to standardize manufacturers' handbooks so as to be uniform with this N. E. L. A. handbook.

Discussion

In opening the discussion on the report of the publications committee, Mr. J. G. Learned, Chicago, told of the good results his company has obtained by sending to each prospective home builder in its territory the Commercial Section pamphlet "Electricity in the Home," accompanied by a letter inviting the addressee to consider the advantages of electric service.

Mr. L. D. Gibbs, Boston, emphasized the fact that the material contained in the residence-service campaign dummy furnishes complete material for a campaign in a community of almost any size, the arrangement being such as to be entirely elastic and to permit the addition of local addenda if desired. This residence-campaign material, he declared, contains "all the selling power it is possible to put into the printed word and pictured page."

Mr. W. A. Donkin, Pittsburgh, reported the good results obtained by sending out association pamphlets in reply to inquiries received from newspaper advertisements.

Mr. H. L. Hamilton, Baltimore, spoke of the advantages and increased effectiveness of mailing advertising matter consecutively and according to a prearranged campaign.

Mr. Dana Howard, Chicago, said that the fact that only 8 per cent of the residences in this country are wired should leave a fertile field of new business for the public utility companies.

Mr. R. S. Young, Newark, N. J., said that in his opinion the failure to make proper use of association literature is due to the lack of proper machinery for circularizing the "prospects" of central stations.

Mr. H. N. McConnell, New York, said that while in the case of the larger cities weekly distribution of literature might be desirable, a monthly plan of campaign would be found preferable for small towns.

Mr. F. C. Pullen, East St. Louis, Ill., said that one difficulty with the advertising matter produced by the association has been the fact that it is directed at the central-station man and thus interests him rather than the housewife or the prospective customer.

Mr. M. E. Turner, Cleveland, suggested that central stations provide their local contractors with circular matter and encourage them to circularize their "prospects" with this advertising material.

Mr. J. F. Gilchrist, Chicago, insisted that to be effective advertising must have "punch."

Mr. F. D. Pembleton, Newark, N. J., said that every business worthy of the name can be built up and improved by judicious advertising, but he recommended that the central station make its advertising part of its house-wiring campaign, accompanying its printed propaganda with consistent efforts in other lines.

On motion of Mr. J. G. Learned, Chicago, it was voted to designate as "salesmen" men engaged in the selling of central-station service.

Mr. M. E. Turner, Cleveland, also urged further standardization in the names of central-station commercial departments and in the titles of their officials, and to this end a committee on commercial department terminology was appointed by Chairman Jones, consisting of Messrs. Turner, Learned and J. F. Becker, who will suggest uniform appellations.

Education of Salesmen

The committee on the education of salesmen, of which Mr. F. C. Henderschott is chairman, presented an outline of a central-station salesmanship course covering a wide range of topics, in response to the expressed desires of about 100 Class A member companies for the better education of their commercial department employees. The suggested course includes corporate organization, the fundamental principles and psychology of salesmanship, contract forms, order routine, credit information, telephone orders, filing systems, campaigns, engineering data, public relations and studies of company advertisements, as an introductory curriculum for all salesmen, with separate specialized topics appealing to the lighting salesman, the motor-service solicitor, and the merchandiser of appliances. A broad treatment of rates is also added, including such topics as meters, tests, rate adjustments, application of company rates, commission regulations, franchises and municipal competition, and the course also includes a study of wiring systems, insurance regulations, estimates for lighting and motor installations and the study of electrical history, generating and distribution systems and effective speaking and business-letter writing. The committee recommended that lectures given by department heads and sub-heads, with appropriate examinations, form the background of the course, with occasional lectures by outsiders on salesmanship, hygiene, personal manners, etc. The aim is to impart the general principles and technique of machinery and the application of electricity as a motive power, scientific illuminant and all-around modern convenience.

Discussion

Mr. H. J. Leask, New York, contrasted the selling of ordinary merchandise with the sale of electric service, and explained that the man who has had long experience in selling ordinary goods must be trained along entirely new lines before undertaking to show prospective customers the service which his company can render them.

Mr. E. W. Lloyd, Chicago, described his plan of a night school with "rotation" students. The men who attend are employed by day and enter the night school with the approval of their superiors, paying for the instruction received. The type of man who after working hard all day is willing to go to night school and to pay for his instruction promises, said Mr. Lloyd, to become a leader in the central-station organization of the future. The universities and technical schools lack courses in commercial instruction. Their curriculums as now arranged provide men for the electrical manufacturers rather than for the central-station industry; hence it has been necessary for the electric-service companies to organize their own courses of commercial instruction.

Mr. M. Hart, Chicago, testified to the successful results obtained with men trained in the Central Station Institute maintained by the Insull interests at Chicago. New graduates of the institute have been placed in competition with local salesmen of many more years' experience and have proved the value of the institute course by producing three or four times the volume of business that has been secured by their untrained competitors.

Unified Network Transmission System in New Jersey

The Public Service Electric Company serves eleven counties with electricity, reaching a population of 2,000,000—Marion, Elizabeth, Camden and Burlington among the important stations

PROBABLY no state in the Union offers a more desirable field for the economical transmission and utilization of energy from a unified network than does New Jersey. With its excellent transportation facilities and its proximity to New York and Philadelphia, this State has become one of the most important manufacturing commonwealths. Its extensive and varied industries and congested population furnish a diversified demand, making for the economical production and delivery of electrical energy.

Electric Service

Eleven counties stretching diagonally across New Jersey from New York City on the northeast to Philadelphia on the southwest are served with electricity from the lines of the Public Service Electric Company, a subsidiary of the Public Service Corporation of New Jersey. In these counties 178 municipalities, having a total population of 1,948,923, receive electric service; 104 cities are served by electric-railway lines, and 109 cities enjoy all three utilities—electric, railway and gas. Although the railway and electric-service organizations are allied, yet they operate as independent companies. Instead of one company generating and selling energy to the other, both organizations have equipment in the same building and each pays a proportionate part of the overhead charge and the maintenance and operating expenses. The combined output of energy of the two utilities in 1913 was 400,835,989 kw-hr., of which 4,068,200 kw-hr. was delivered to industrial motors and 141,936,243 kw-hr. to street-lighting equipment.

FIG. 1—HOME OF THE PUBLIC SERVICE CORPORATION

The Public Service Electric Company divides the territory it serves into six divisions: Bergen, Essex, Passaic, Hudson, central and southern. In the central division are the following counties: Union, Middlesex and Somerset; in the southern are Mercer, Burlington, Camden and Gloucester. Geographically these six divisions group themselves into three main sections, the northern, central and southern. The northern and central sections are interlinked electrically, but the southern district operates separately.

The main generating station in the northern division is situated at Marion, several miles east of Newark. Transmission lines connect this station with Newark and radiate from both places in several directions, delivering energy as far north as Ridgewood and as far south as New Brunswick. The station at Marion is supplemented by another at Perth Amboy in the central division.

Before long a new station will be erected near Newark which will have an ultimate rating of 150,000 kw. Only 50,000 kw in equipment will be installed for the present, however. It will be run in parallel with that in the Marion station. The new station will feed all of Essex County and most of the central division, while Hudson, Passaic and Bergen Counties will absorb the output from the Marion station.

The transmission system in the central division, instead of being laid out radially, is in the form of a network. The company's most modern substation, which is at Elizabeth, connects the two districts. Both sixty-cycle and twenty-five-cycle energy are transmitted in the northern division, the sixty-

cycle energy being used exclusively for lamp and motor service while the lower frequency is employed for railway service. Only sixty-cycle energy is employed in the central and southern divisions. The energy is transmitted at 13,200 volts except in a few instances in the southern division.

The southern district is less developed electrically than the others, and the transmission system is spread out over a longer stretch without the interlinking network of lines. The main station in this division, which is just being completed, is at Burlington, about midway between the extremities of the system. It is supplemented by generating stations at Camden, Trenton and Gloucester. All of the energy is transmitted at sixty cycles, and except north of Trenton and out of Camden the emf is 13,200 volts. From Trenton 6600-volt lines extend northward to Lawrenceville and Princeton, while the towns of Woodbury, Gloucester, Haddon Heights, Merchantville and Moorestown are supplied with

FIG. 2—MAIN-FLOOR ENTRANCE TO OFFICE BUILDING

11,000-volt energy from Camden mainly for the purpose of utilizing equipment which was installed in those places when the Public Service Electric Company took over their management. Of the last-mentioned lines, the one to Haddon Heights and the one connecting that place with Gloucester are single-phase circuits. As the load increases in these sections three-phase, 13,200-volt lines will replace those now installed.

History of Company's Growth

Many of the public utilities in New Jersey had become practically insolvent prior to the spring of 1903, when the Public Service Corporation of New Jersey was organized to rehabilitate them. On June 1 of that year the company began its business existence, having as its chief subsidiary the Public Service Railway Company, to which all of the railway interests were leased or merged. The various electric light and power properties were operated by the electric department.

The original system consisted of fourteen generating stations, nine substations, 47 miles of 6600-volt transmission lines, and 25 street miles of underground conduit. The generating equipment consisted of 156 generators having an aggregate rating of 40,075 kw, the

FIG. 3—MAIN-FLOOR LOBBY IN OFFICE BUILDING

largest unit being rated at 850 kw. The total output for the first year was 129,614,810 kw-hr.

The principal stations in 1903 were Hoboken, Wayne Street, Paterson, Passaic, Orange, City Dock, Elizabeth, Camden and Trenton. The other five were very small stations. It was not until about a year later that the railway stations were officially taken over, although they were operated by the electric department previous to that time.

From the beginning the system expanded rapidly, the smaller generating stations being superseded by substations receiving energy from central generating stations and the suitably located generating stations being re-equipped with standard apparatus except where new stations were erected in their place. Table I indicates the growth of the system from year to year.

The first real efforts to establish a large central gen-

FIG. 4—DISPLAY ROOM IN BASEMENT OF OFFICE BUILDING

erating plant were made in 1904, when construction on the Marion station was started. The lighting and motor-service business was slow in growing at first. Lighting substations began to get a foothold in 1905, Orange being one of the first to have such equipment.

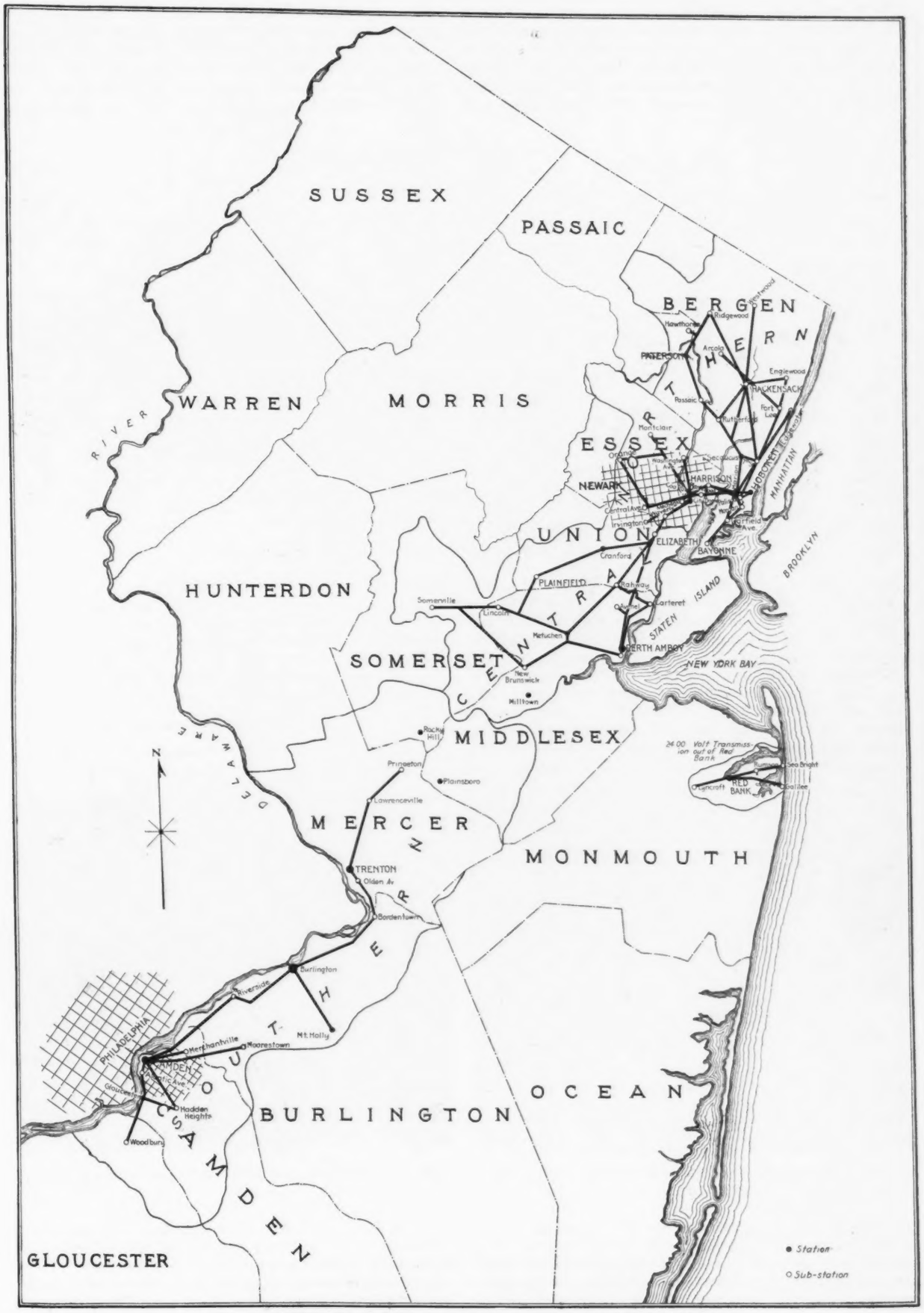


FIG. 5—TERRITORY SERVED BY PUBLIC SERVICE ELECTRIC COMPANY

Up to this time considerable progress was being made in the central division in relocating plants and substituting substations for the small uneconomical stations. The southern division began to develop most rapidly about 1906, when the equipment of the Camden and Trenton stations was increased. The two-phase industrial-motor load increased considerably in 1911, and several substations were established to meet the demand. One of the most important events in 1912 was the adoption of automatic feeder voltage regulators as a permanent feature in the sixty-cycle system.

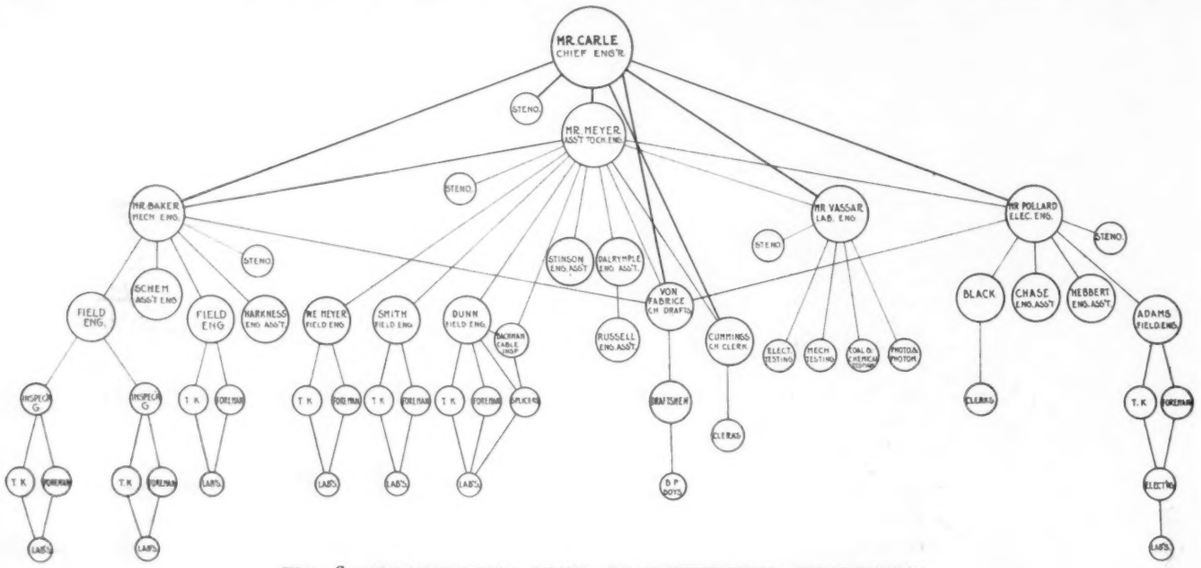


FIG. 6—ORGANIZATION CHART OF ENGINEERING DEPARTMENT

The original electrical equipment of the Public Service Corporation consisted of mixed twenty-five-cycle and sixty-cycle apparatus. To prevent complications in transmission and distribution construction and to simplify station operation it has been the policy of the electric-service company ever since its organization to concentrate gradually the twenty-five-cycle equipment in the Hudson division, where the heaviest railroad load exists, and use only sixty-cycle apparatus elsewhere. In re-designing the system there has been a tendency toward replacing synchronous converters by motor-generator sets and employing large air-cooled transformers instead of the oil-cooled type. To accomplish the end in view—that of having standard equipment occupying as little space as possible—it has been the practice when equipping a small substation to utilize some of the low-rated and older equipment from the larger substations or stations and buy new and higher-rated and more compact apparatus for the standard equipment. Except as circumstances alter the case, the company does not intend to buy any new transformers rated below 1000 kw. It has been found that to install an air-blower system and use air-cooled transformers requires less floor area than do the oil-cooled type, and hence the new transformers are of the former type.

FIG. 7—INTERIOR OF APPLIANCE DISPLAY ROOM AT CAMDEN, N. J.

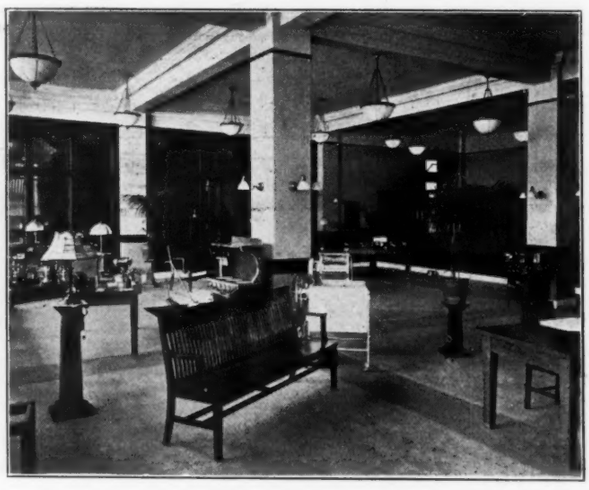


FIG. 8—INTERIOR OF APPLIANCE DISPLAY ROOM AT ORANGE, N. J.

Diversified and Concentrated Demand

Although forty-fifth in area among the forty-eight states, New Jersey ranks third in density of population (United States Census, 1910), having 337.7 people per square mile. Seventy-five per cent of the people live in cities and incorporated towns of 2500 or over. Nine cities in the State have populations over 50,000, Newark having 347,469 inhabitants, Jersey City 267,779, Paterson 125,600, Trenton 96,815, Camden 94,538, Elizabeth

73,409, Hoboken 70,324, Bayonne 55,545 and Passaic 54,773. There are twenty-three other cities having populations between 10,000 and 50,000, and these thirty-two cities contain 64.7 per cent and 74.3 per cent of the total population and industries of the State.

New Jersey has attained its industrial prominence because of its exceptional geographical location and transportation and coast-shipping facilities. The close proximity of the Pennsylvania coal mines and the markets of Philadelphia and New York have also influenced the growth of the manufacturing concerns. The area of the State is 8224 sq. miles, of which 710 sq. miles is water surface, and 319 miles of the coast are navigable.

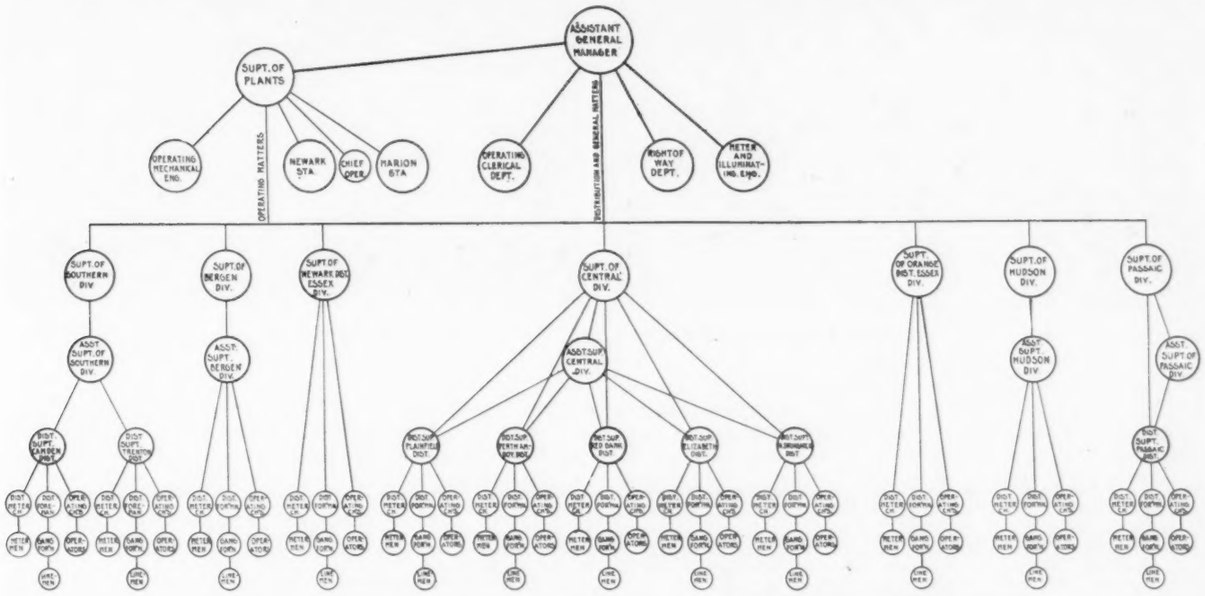


FIG. 9—ORGANIZATION CHART OF OPERATING AND DISTRIBUTING DEPARTMENTS

of the amount of labor employed. Some of the industries, arranged in order of the capital invested, will be found in Table II.

The last United States Census indicates that in 1909 182,475 hp in industrial apparatus in New Jersey was run by motors. Eighty-one per cent of the electrical energy was generated in private plants and 18 per cent was supplied by the electric-service company. Since

FIG. 10—VIEW OF SWITCHBOARD GALLERY, MARION GENERATING STATION

FIG. 11—COAL-HANDLING APPARATUS IN OPERATION, MARION STATION

In the gross value of products manufactured New Jersey ranks sixth among the states. During 1909 8817 manufacturing establishments were in operation, and the total value of their outputs was $1,145,529,000. Raw material for manufacturing cost $720,033,000, making the net value added by manufacture $425,496,000. From 1849 to 1909 the gross value of manufactured products increased from $81 to $540 per capita.

Smelting and refining of copper is the most important industry viewed from the value of the product, but the manufacture of silk goods is pre-eminent in terms of the amount of labor employed. Some of the industries, arranged in order of the capital invested, will be found in Table II.

The last United States Census indicates that in 1909 182,475 hp in industrial apparatus in New Jersey was run by motors. Eighty-one per cent of the electrical energy was generated in private plants and 18 per cent was supplied by the electric-service company. Since then steam engines have been gradually replaced by gas engines and electric motors, and a census taken recently by the Public Service Electric Company of New Jersey shows that the use of motors operated from its lines is on the increase. Of the equipment not operated by central-station energy 88.3 per cent is belt-

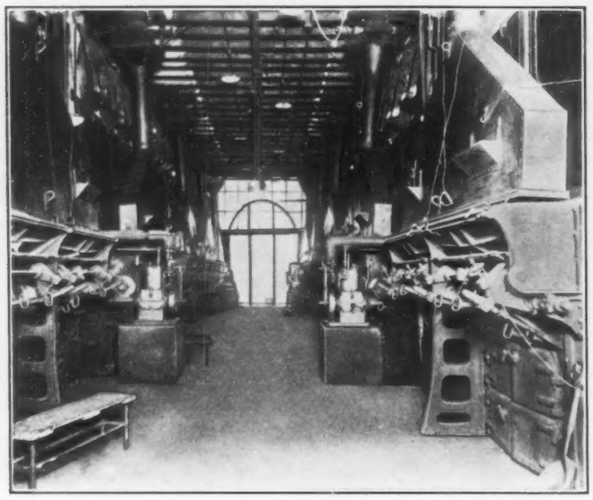


FIG. 12—SECTION OF BOILER ROOM, MARION OPERATING STATION

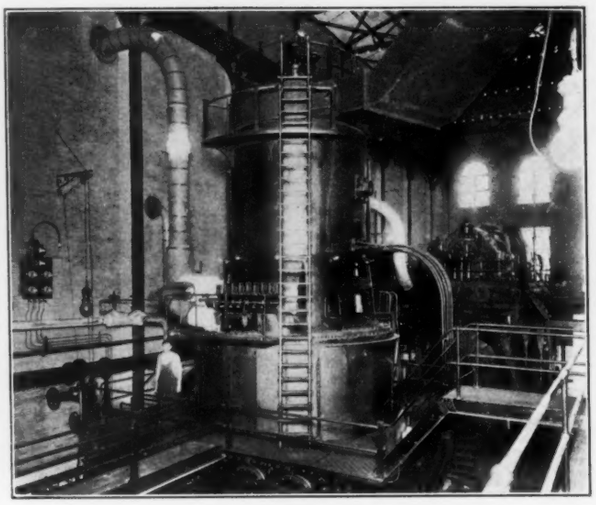


FIG. 14—INTERIOR VIEW OF MARION GENERATING STATION

driven by steam engines and only 11.7 per cent is operated by electric motors fed with energy from private plants.

TABLE I—GROWTH IN GENERATING AND SUBSTATION EQUIPMENT

Year	Generating Stations	Generating Units	Kw Installed	Substations	Synchronous Converters	Kw Installed
1903	14	156	40,075	9	..	.....
1904	24	...	61,000	18	16	7,600
1905	27	...	75,000	27	34	15,000
1906	27	...	96,000	36	..	40,000
1907	..	...	100,000	38	..	50,000
1908	..	...	.....	..	..	.....
1909	23	228	105,500	40	63	42,750
				75 ltg., trans.	..	25,000
1910	28	189	124,158	42	73	50,200
				95 trans.	..	28,500
1911	30	193	134,158	46	75	52,700
1912	32	201	147,408	50	84	65,000
				151 trans.	..	74,000
1913	32	203	177,048	56	..	.....

In December, 1910, a uniform rate schedule was inaugurated, and the following year 9200 hp in industrial motors was added to the company's lines. In 1912 contracts amounting to 16,200 hp were closed for industrial motor service, and in 1913 21,600 additional hp was connected. During the first four months of 1914 the new-business department secured contracts for supplying 17,000 hp in motors, of which 7500 has been connected already, the remainder being under contract for early connection. This makes a total growth in the industrial-motor business of 64,000 hp from January, 1911, to May 1, 1914.

TABLE II—DATA ON NEW JERSEY INDUSTRIES

Industry	Capital Invested	Value of Yearly Output
Oils	$74,000,000	$99,000,000
Machinery	59,000,000	43,000,000
Chemical products	43,000,000	44,000,000
Brewery products	40,000,000	22,000,000
Silk and ribbon goods	37,000,000	52,000,000
Cigars and tobacco	34,000,000	33,000,000
Rubber	31,000,000	38,000,000
Electrical appliances	24,000,000	21,000,000

The industries of the State are of various natures, about 25 per cent of the total hp being required in metal

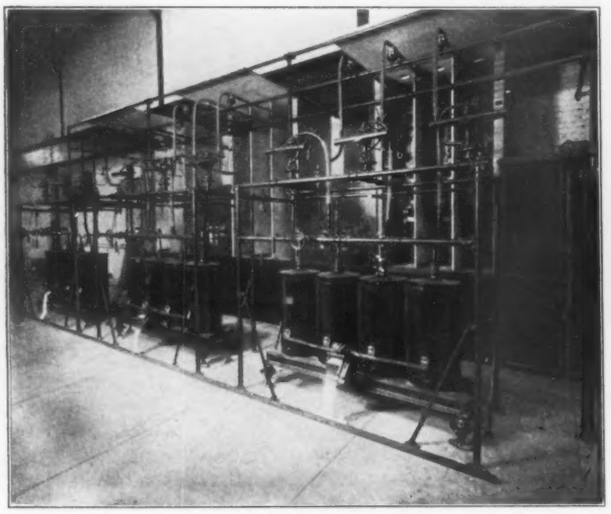


FIG. 13—SUBSTATION LIGHTNING-ARRESTER EQUIPMENT, ELIZABETH

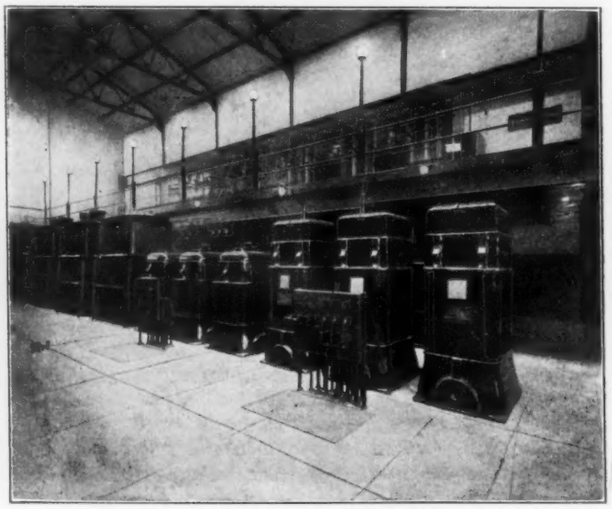


FIG. 15—AIR-COOLED TRANSFORMER EQUIPMENT IN ELIZABETH SUBSTATION

FIG. 16—INTERIOR VIEW OF SUBSTATION AT ELIZABETH

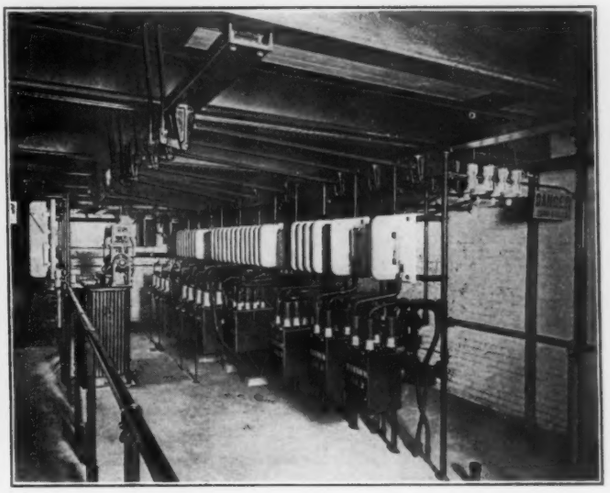


FIG. 18—OIL-SWITCH ROOM IN ELIZABETH SUBSTATION

working and about the same percentage in textile mills. Of the remaining industries, rubber and woodworking each demand about 4 per cent of the energy delivered for this class of service. Approximately 600,000 hp in motors is now connected to the company's lines.

Present Equipment

The electric-service company now utilizes 576 miles of transmission line and 119 street miles of underground conduit. The distribution system is just as extensive, there having been 14,070 miles of wire, 131,232 poles, 16,348 transformers and 96,486 connected meters in use on Dec. 31, 1913. For generating and transforming the energy used in this system the company operated thirty-two generating stations and fifty-six substations. In the generating stations 268 boilers and 203 generators are installed, with an aggregate rating of 177,048 kw.

Largest Generating Station

The largest generating station in the system is on the Hackensack River at Marion, Jersey City, N. J. It was built in 1904, three vertical Curtis turbine-driven General Electric 13,200-volt generators being installed at the first. One of these units (a 3000-kw machine) was designed for sixty-cycle operation to carry lighting loads; the other two (5000-kw units) furnished twenty-five-cycle energy for railway service. The dual system was adopted because the subsidiary companies had already committed themselves to using twenty-five-cycle apparatus for railway work as sixty-cycle converting units were not practicable at that time. The policy of concentrating energy generation in central stations was further carried out at this station by periodic additions to the generating equipment. In 1907 a 3000-kw, sixty-cycle generator was installed; in 1909 the station was extended and two 9000-kva vertical units added (one for railway and the other for lighting), and in 1912 a seventh generating unit, rated at 9000 kva, was erected to carry the local railway load. The station now has 28,000 kw in twenty-five-cycle and 47,000 kw in sixty-

TABLE III—GROWTH OF TRANSMISSION SYSTEM

Year	Miles Transmission	Street Miles Conduit	Kw-hr. Output
1903	47	25	129,614,180
1906	300	50	.....
1911	425	87	.....
1912	475	101	357,289,241
1913	576	119	400,835,989

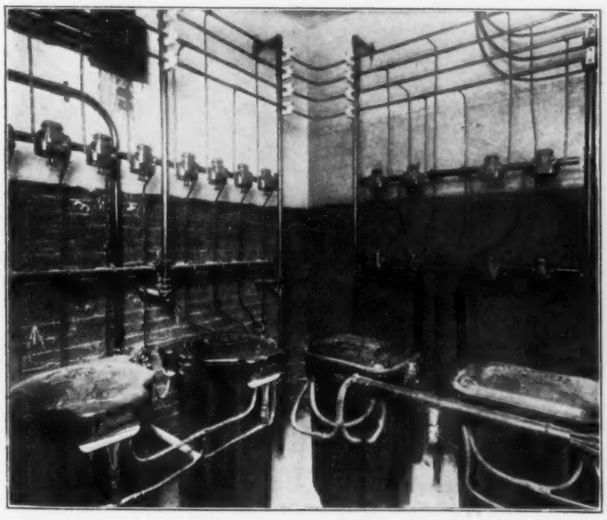


FIG. 17—SUBSTATION-SERVICE TRANSFORMER ROOM AT ELIZABETH

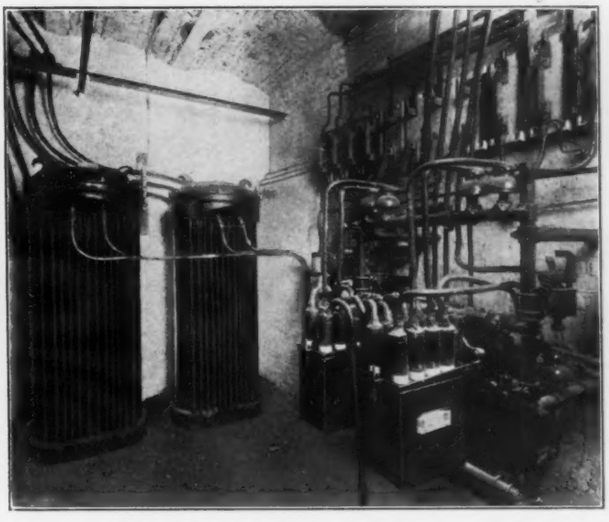


FIG. 19—VIEW OF TYPICAL TRANSFORMER BANK, VAULT CONSTRUCTION

cycle equipment divided up among seven vertical General Electric units and one Westinghouse horizontal-type generator. The horizontal unit, which is a sixty-cycle generator rated at 20,000 kw, is installed in space provided by an extension to the building. At the time (December, 1913) this machine was installed it was the largest sixty-cycle unit in the world.

The boiler room of the Marion plant has forty-five Babcock & Wilcox boilers delivering steam at 195 lb. pressure and having a total rating of 28,125 boiler-hp. The units are arranged in groups of five along opposite sides of the firing aisles, which run perpendicular to the length of the engine room. Each set of ten boilers is in a compartment by itself and discharges smoke into a stack 225 ft. high. Reinforced-concrete coal bunkers built above the boilers and beneath the roof discharge coal through spouts into the furnace stokers.

Coal for the station is delivered in barges to the dock on the Hackensack River, where clamshell buckets operated from a hoisting tower unload the fuel into a belt conveyor running parallel to the boiler room on the north side.

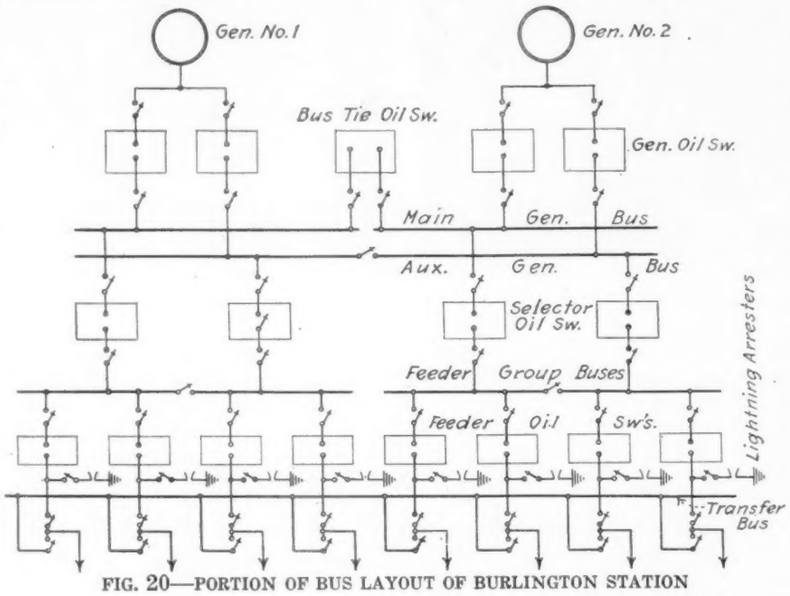


FIG. 20—PORTION OF BUS LAYOUT OF BURLINGTON STATION

Load Dispatching

Station operation in the whole northern section is supervised from the Marion generating station. One chief dispatcher and three assistants are employed at Marion. Their duties are to arrange for the operation of generators which will supply the demand at the best efficiency, power-factor and load-factor. Load dispatching does not consist alone in keeping the requisite number of units operating, but also in concentrating the generation of energy in as few plants as possible so that the plant efficiency will be maintained at a high value. In the northern system the policy is to operate Marion at as near constant and full load as possible and as peak demands come on to obtain energy from Newark stations and, when absolutely necessary, from the smaller plants in the system. It is usually during railway peak that it is necessary to operate the smaller stations. A load dispatcher under the supervision of the Marion dispatcher is stationed at Perth Amboy in the central division.

Another service which is performed by the load dispatchers is to supervise all tests on underground cables, aerial line and station apparatus, so that no portion of the system is handicapped for carrying its respective load. In "weeding out" cables by high-voltage or ohmic-resistance tests, attempts are made to confine the work to one locality so that if a break-down occurs energy can be delivered over another route. In repairing station apparatus similar precautions are taken to avoid conducting too many repairs in the same district. The load dispatcher, who is at all times informed as to the condition of apparatus, indicates on a diagram of the system just what apparatus requires attention and

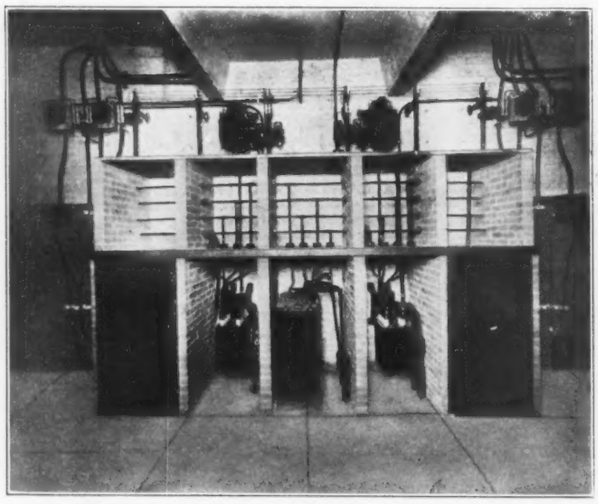


FIG. 21—INTERLOCKED SYNCHRONOUS MOTOR STARTER IN SUBSTATION

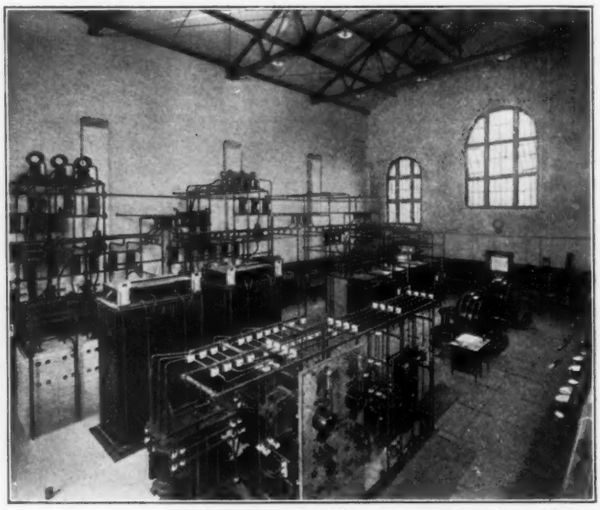


FIG. 22—VIEW OF THE INTERIOR OF THE SUBSTATION AT RIVERSIDE

Energy distribution in the southern division is not complicated or developed enough to warrant a load dispatcher, but as soon as the field is developed a dispatcher will be stationed at the new Burlington station.

what machines are undergoing repairs at the time he fills in the chart.

While the southern system will eventually be supplied with energy from a central plant at Burlington, the supply for Trenton and vicinity is at present being furnished by the Trenton station, and energy for Camden and vicinity is being generated at Camden. Cities

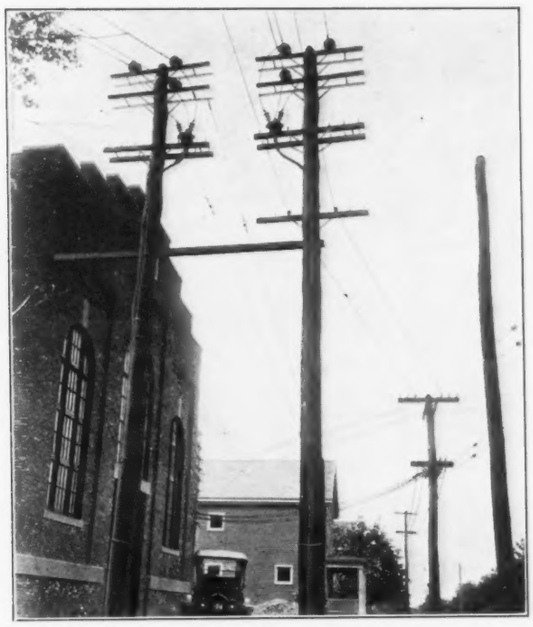


FIG. 23—TYPICAL UNDERGROUND CABLE ENTRANCE TO SUBSTATION

and towns between these generating stations are served in general from the nearest generating plant through a substation.

Location of Faults

Owing to the rapid increase in the size of the generating plants and transmission system in the northern part of the State, a serious problem has had to be contended with—that of protecting the system from short-circuits. The interruptions to service from 1910 to 1913 are classified in Table IV. From the figures it can be seen that most of the trouble was caused by insulator and cable failures. For this reason apparatus was installed in the Marion station to secure data on why the faults develop and thereby obtain a basis on which to remedy the trouble. The equipment consists of a high-potential testing transformer, a high-frequency testing transformer, a permanent installation of

TABLE IV—SERVICE INTERRUPTIONS BY YEARS

Year	1910	1911	1912	1913
Central station	5	13	12	12
Substation	28	21	24	36
Line and cable trouble	81	114	129	155
Total	114	148	165	203

a resistance recorder, and an arcing-ground suppressor and localizer.

The test emf used on this system is 26,000 volts for new cable and 20,000 volts for cable in service for some time. The potential is applied for five minutes, between phases and between each phase and ground. The records show that most of the cable faults occur at joints, the reason assigned being trapped air and moisture. High-frequency tests on insulators taken from the lines of this transmission system show that failure is attributable to non-uniformity in the design and manufacture of the insulator. Insulation-resistance tests show that just at daylight on a summer morning the insulation resistance drops to a very low value for a short time. There have been several cases of insulation failure at this time of day, attributed to the fact that the warm morning air striking a cold insulator deposits moisture thereon and causes a flashover. The insulation resistance of the system as recorded on the charts varies between 500,000 ohms and 2000 ohms. During a heavy rainstorm the resistance drops considerably, and it does not rise again until the sun dries the insulators after the storm.

The arcing-ground suppressor and localizer is used to suppress a single-phase arc to ground and to indicate

TABLE V—INTERRUPTIONS DURING 1913 CLASSIFIED

	Twenty-five Cycle		Sixty Cycle	
	Number	Per Cent	Number	Per Cent
Insulator failures	12	22	30	20
Cable failures	2	4	21	14
Central-station apparatus	3	5	4	3
Substation apparatus	2	4	7	5
Secondary feeder	5	9	23	15
Operating mistakes	2	4	10	7
Storms	9	17	16	11
Outside interferences	9	17	22	15
Mechanical breaks	0	0	0	0
No apparent cause	10	18	15	10

the cable which is at fault. Records show that 90 per cent of the cable failures originate in a single-phase arc to ground, which later develops into a short-circuit. After the suppressor and localizer have operated, a good cable is paralleled with the bad one and the faulty cable taken out without any interruption to the service.

Typical Substation

The electric company does not confine its efforts along modern attractive construction to the larger generating stations and substations. Even the smallest trans-

FIG. 24—AERIAL CABLE LEADING TO CAMDEN STATION

former station is designed along lines which are a credit to the system. Every effort is made to arrange for convenient operation, and the desire to maintain a station in its most attractive condition is instilled into each operator.

The Elizabeth substation, furnishing energy for railway, lighting and motor service, is the latest development in substation construction. It is a model of comprehensive construction, the 13,200-volt lines entering on one side of the building and the low-tension feeders leaving the structure on the other side, both underground and overhead. The high-tension circuits enter

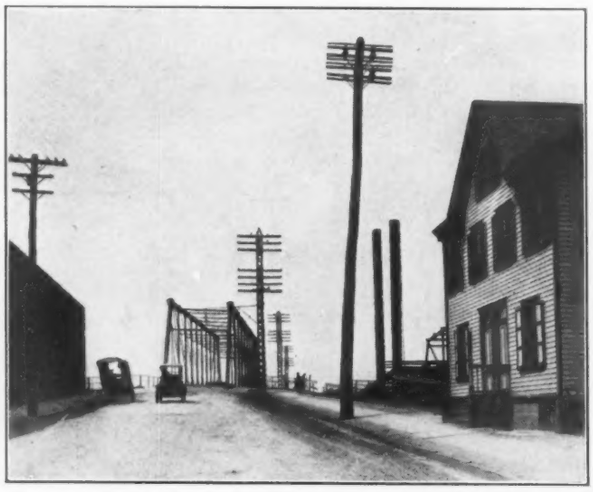


FIG. 25—CROSSING OVER PENNSYLVANIA RAILROAD YARDS AND CANAL

the building through specially designed wall entrances consisting of condenser-type bushings inclosed in tile ducts which are supported in slate slabs set at an angle in the wall. No protective hoods are employed to protect the entrances from the weather, the inclined position of the slabs being considered sufficient. In the future high-tension circuits will be conducted to the buildings through three-phase underground cables as is done in some cases now, thus avoiding the use of wall entrances. In the interior of the substation the apparatus is arranged in sequence of energy transformation. The lightning arresters are on a gallery near the

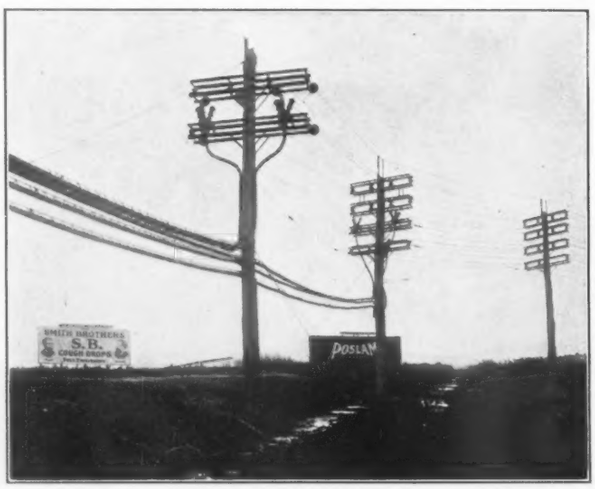


FIG. 26—13,200-VOLT AERIAL CABLE TO AVOID OPEN WORK

incoming lines; the oil switches are on the main floor directly below; duplicate-bus structures are in the basement. Transformers feeding energy to synchronous converters, motor-generator sets and distributing circuits are arranged in a single row on the main floor adjacent to the gallery. They are cooled by air delivered to them through a duct in the basement. Four motor-driven blowers take air either from outdoors or from the station and force it through the transformers into the substation. The room containing the storage batteries for operating the remote-control switches is also ventilated from the air duct. The bus compartments are not in the path of the air draft and hence will not be covered with dust entrained in the air.

Two 1000-kw synchronous motor-generator sets are operated from the 2400-volt bus and one 500-kw and one 1000-kw six-phase converter are fed from their respective transformers. The high-tension buses supplying energy to these transformers are sectionalized so that railway equipment and lamp and motor equipment may be operated independently. All low-tension wiring is inclosed so that there is no exposed wiring in the station. A 2400-volt transfer bus is installed along the low-tension side of the station so that any feeder voltage regulator may be disconnected and the circuit completed through another regulator or connected to the feeder without regulation. One continuous conduit running along the wall back of the feeder regulators contains their control wiring and motor circuit. The circuits emerge at each regulator through special outlets and terminal boxes.

The lighting of the substation is unique and ornamental. Each vertical post in the railing surrounding the gallery is extended above the top rail to support

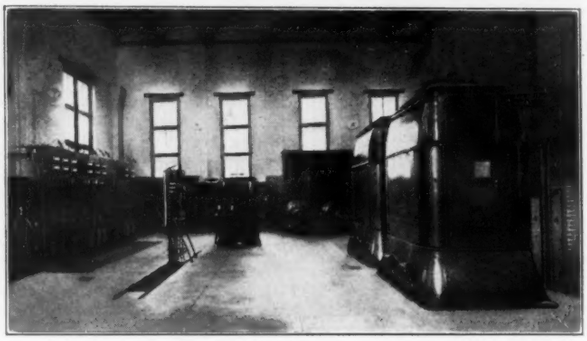


FIG. 27—LIGHTING SUBSTATION IN NEWARK

a diffusing glass-globe fixture. Fastened to the girders around the edge of the gallery are bracket fixtures supporting similar bowls. This system of lighting is more practical than having fixtures supported from the roof trusses, and it adds to the attractiveness of the interior. The lamps are controlled from the main floor. An automatic switch near the lamp-control cabinet instantaneously throws the lamps onto the storage-battery circuit in case the alternating-current supply is interrupted. Means are provided for delivering apparatus and supplies at grade and conveying them to any part of the substation by a crane.

Latest Developments

Developments in the southern division are interesting because this territory presents particularly desirable conditions for electrical development and has not been canvassed to any great extent heretofore for business. Conditions existing there have considerable bearing on the location of the company's latest and most modern generating station at Burlington. With the formation of the Public Service Corporation of New Jersey, the South Jersey Gas, Electric & Traction Company was leased for a period of 900 years. This property, which included the railway, gas and electric interests, covered a field of operation in a territory about 45 miles in length, extending from Trenton on the north to the cities of Camden and Woodbury on the south, including the cities of Gloucester, Bordentown, Beverly and

thirty-seven other municipalities. In addition to this, the company served Bristol, Yardley and Morrisville, in Pennsylvania. During 1913, however, the Public Service Corporation disposed of its Pennsylvania properties so that at the present time the activities of the electric company are wholly confined within the State of New Jersey.

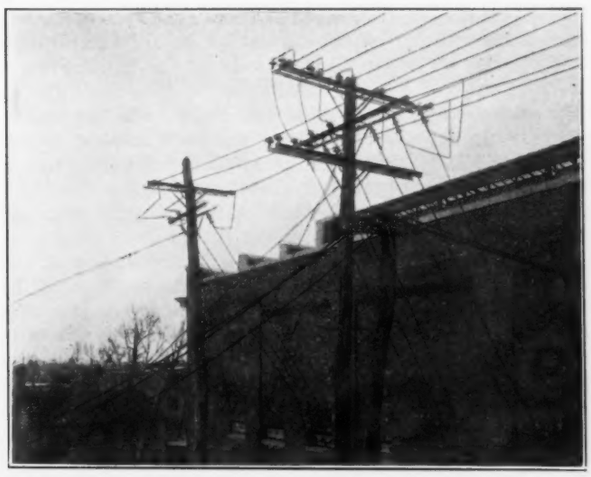


FIG. 28—POLE CONSTRUCTION AT ELIZABETH SUBSTATION ENTRANCE

The population of the territory served increased from 210,000 in 1900 to 310,000 in 1910. Originally there were five generating stations, situated respectively at Camden, Trenton, Mount Holly, Gloucester and Bristol, substations also being maintained at Gloucester, Haddon Heights, Merchantville, Moorestown and Woodbury.

During the period from 1903 to 1911 no extensive improvements to the property were made, other than the installation of additional equipment at Camden, Trenton and the various substations. During 1911 several new local systems were acquired or leased and transmission lines were built connecting them. The

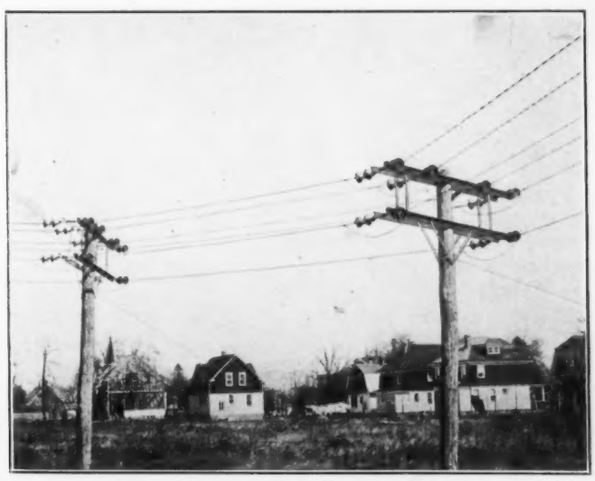


FIG. 29—METHOD OF TURNING AN ANGLE OF 45 DEG.

acquisition of these new properties increased the number of municipalities served by the electric company in this division from thirty-seven in 1903 to forty-eight in 1912.

The combined lighting and railway load of the southern division is over 15,000 kw, which, under expected conditions, will doubtless increase to at least 35,000 kw within the next five years. The load now carried by the Camden stations is approximately 9000 kw, while at Trenton the load has exceeded 3500 kw, the balance being carried by the other smaller stations. Both the Camden station and the Trenton station have reached their practical operating limit, and the apparatus at the other recently acquired stations is not only incapable of properly taking care of the requirements but is inefficient and cannot be depended upon for any length of time without very expensive alterations.

The needs of the situation gave rise to two plans—namely, (1) to increase the station equipment at Camden and Trenton, and (2) to build a generating station somewhere along the Delaware River which would take care of the entire growth of the division.

The situation at Trenton was such that no extensive improvements in the way of additional equipment could be made on account of the lack of water for condensing purposes and the insufficient room for the proper handling and storage of coal. At Camden the question of coal storage was also serious as Cooper's Creek is quite frequently frozen over during the winter months, when coal cannot be transported to the station. While

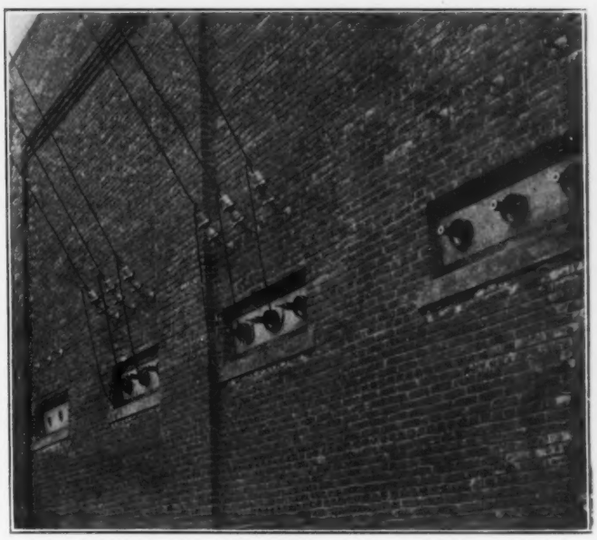


FIG. 30—HIGH-TENSION WALL ENTRANCE AT ELIZABETH SUBSTATION

the necessary amount of coal could be obtained in the summer months, the depth to which it would have to be stored, owing to the lack of space, would result in fires from spontaneous combustion; and, even though insured, the loss due to the extra labor required could not be recovered. Water conditions in Cooper's Creek, arising from the exceptionally low tides, have on several occasions caused interruptions to the service. Even though it were possible to make extensions to the Camden station, Trenton would not have been provided for.

The distance between Trenton and Camden is approximately 36 miles, and the logical location for a generating station was at the geographical center of this territory, or Burlington, on the Delaware River, where the new station is now being erected.

With the station situated at this place and connected with Camden and Trenton by transmission lines it is possible to take care of the growth in load at Trenton, Camden and the intervening territory. By erecting the station at Burlington, too, the transmission distances were cut in half, permitting the economical use of the transmission voltage now standard in other parts of the system and thus allowing for the interchange of apparatus at any time desired.

FIG. 31—TYPICAL DISTRIBUTION CIRCUIT, SHOWING SERVICE DROP AND JOINT-POLE USAGE

Burlington Generating Station

The property on which the new station is being erected is on the Delaware River and consists of somewhat more than 8 acres, part of which is submerged during high water. The lower portion of the property will provide ready means for ash disposal for some years to come. The ultimate plans call for a building constructed on the unit system, approximately 200 ft. in width by 300 ft. in length, only the first section of which, however, is now under construction. Two 3500-kva, sixty-cycle, 13,200-volt, three-phase, vertical Curtis turbo-generators units which were formerly at Marion station are being installed. Space has been provided for the installation of a third unit, and the arrangement of the building and main condensing canals is such as to permit an ultimate installation of 10,000-kw horizontal turbine units, with a final station rating of 100,000 kw.

The boiler equipment in the first section consists of six 600-hp water-tube Edge Moor boilers, with space provided for two more. On the opposite side of the firing aisle there is room for eight more units. These boilers will be hand-fired for the present, but provision has been made for the installation of stokers when the size of the station seems to warrant their use. The first installation of boilers will require only one stack, which will be of radial brick construction, having an inside diameter of 14 ft. with a height of 225 ft.

Like many of the other stations, the building will also house substation apparatus, which, for the present, will consist of two 300-kw converters for railway service and two 500-kw oil-cooled transformers for lighting and motor service. The switch house, which consists of four floors, will have space for both generator and feeder reactors, although these will not be installed at present. The outgoing high-tension feeders will be arranged in groups of four, with an auxiliary and transfer bus forming a selective system.

Considerable care is being taken in the design of the switchboard and feeder system, in order to provide as flexible an arrangement as possible, thereby insuring continuity of service; and the design of the station throughout is such as will provide the southern division with a plant superior to any now existing in Public Service territory. The feeder system includes substations at Mount Holly, Riverside, Bordentown, Olden Avenue and Liberty Street, the last two being in Trenton. Two 300-kw rotaries are installed in each of the last two substations.

Substations in Southern Division

The Riverside and Bordentown substations are equipped with two 500-kw oil-cooled transformers for lighting and motor service. Olden Avenue substation, which is in the center of a factory district and which is being built primarily to take care of large contemplated motor-service business, will contain two 1000-kw air-blast transformers.

In the case of the Riverside and Bordentown substations it was desired to keep the cost as low as possible, and as oil-cooled transformers of proper size were available in other parts of the system, it was decided to use them. The installation of this type of transformer also greatly reduced the building cost. At Olden

FIG. 32—750-FT. TRANSMISSION SPAN USED IN CROSSING RANCOCAS CREEK

FIG. 33—STANDARD TYPE OF HIGH-TENSION RAILROAD CROSSING

Avenue it is expected that a much heavier load will be carried than at either of the other two substations, and for various reasons it was deemed desirable to install air-blast transformers.

The Burlington station will also supply energy to substation apparatus at both Trenton and Camden. As the Camden station is operated at 11,000 volts, auto-transformers are provided to compensate for the difference in voltage in order to allow parallel operation with the 13,200-volt system.

Latest Transmission Construction

The southern division transmission system has required the building of 51 miles of pole line, a large portion of which is on public highway. The lines, with the exception of the circuit to Mount Holly, are of No. 00 seven-strand medium hard-drawn bare-copper wire, with Locke No. 3¾ insulators and metal arms, mounted on wooden poles, most of which are 50 ft. in height. On each side of a telephone or railroad crossover the poles are double-cross-armed, and where possible the poles are guyed straight-away and transverse to the line. When the line extends along an existing or future street right-of-way the poles are set within the curb line in order that they may not have to be moved when the streets are graded or paved. In crossing gullies or depressions the practice is to keep the line practically level from ridge to ridge by employing gradually taller poles in the lower parts of the depression.

Where the poles have to be set in marsh land the butts are usually steadied by cribs made of timbers fastened to the butt at right angles to each other. The strain on poles at turns is minimized by dividing the turn up among several short spans. Each pole on a turn is double-cross-armed and is equipped with spool-type insulators. The pole at which the straight-away line terminates is anchored longitudinally and also side-guyed.

In several cases in the southern division where a straight-away line runs into an obstruction it has been considered advisable to raise the line and pass over the obstruction rather than make an offset. This practice has been followed where possible by using poles of gradually increasing height just before approaching an obstruction and decreasing height in receding from it. The objection to an offset is that it imposes unnecessary strains on the poles and adds complications to the construction.

A bold departure from ordinary line construction is

FIG. 35—STREET ON WHICH OVERHEAD CONSTRUCTION HAS BEEN SUPERSEDED BY UNDERGROUND

made by the Public Service Electric Company in crossing streams, railroads and other obstructions. Instead of grading the line up to the towers on each side of the obstruction this company runs its line conductors directly up from 50-ft. poles to towers which are 150 ft. to 174 ft. in height. By so doing the maintenance of several high approach poles is eliminated. Besides, the conductors are not subjected to as great a tensile strain when suspended practically vertically as if strung tight in a horizontal plane. About seven high towers with steeply inclined line approaches are employed in the New Jersey system.

Two large steel towers were required in crossing over Rancocas Creek on the Camden Turnpike, the span employed being 770 ft., which is the longest in the system. The towers are constructed of steel 20 ft. square at the base and are high enough to allow a minimum clearance of 130 ft. from high-water line to the lowest wire, this being the requirement of the federal government. The towers are designed to carry twenty-five wires, which will be so spaced as to allow the use of 26,000-volt transmission should this ever become desirable.

The crossing is novel in that a right-angle turn had to be made not more than 150 ft. from the base of one tower. The tower nearest the turn is 176 ft. high and the conductors are stretched from the insulators sus-

FIG. 34—JUNCTION OF PRINCETON AND TRENTON LINES TO BORDENTOWN

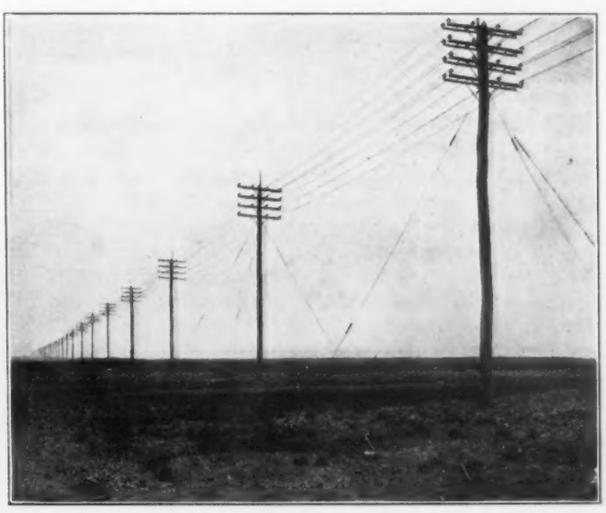


FIG. 36—TYPICAL HIGH-TENSION TRANSMISSION LINE NEAR NEWARK

pended thereon to a wooden bent 88 ft. from the base of the tower and thence to another three-pole frame 8 ft. away. As the right-of-way was limited in width, the next pole had to be offset from the line in a direction opposite to the turn desired, so that conductors were dead-ended in disk insulators and connected with the lines running at right angles to the cross-over span.

On account of the height of the tower it was considered necessary to use a ground wire. This is supported at the apex of each tower and has the same conductivity as each conductor. The ends of the ground wire extend to disk insulators attached to the bents and are connected to earth near them. Aside from ground wires on high towers no others are used on the southern division transmission.

Similar towers supporting thirty-six conductors are used in crossing over Cooper's Creek near the Cam-

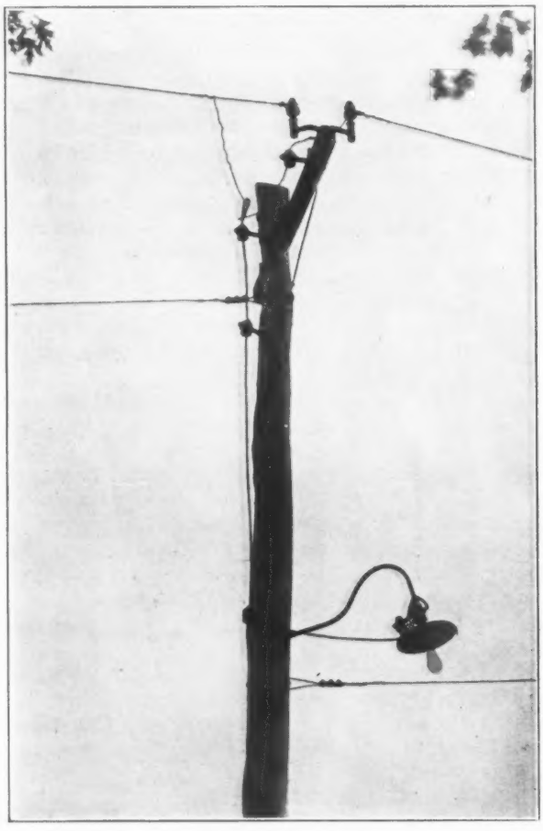


FIG. 37—STANDARD SERIES STREET-LIGHTING CONNECTION

den station. Small steel towers are also employed in the vicinity of Trenton, where the line crosses the Pennsylvania Railroad Company's property near the Delaware River and Raritan Canal.

To avoid the use of open high-tension construction entering Camden, and as no underground franchise was held, 13,200-volt overhead cable supported on messenger wire was installed. The cable contains three-conductors, is paper-insulated, and has a jacket of cloth and rubber, over which weatherproof braid and soft steel tape is applied. A covering of jute is provided to protect the steel tape from corrosion. This type of construction is a new departure and more or less of an experiment. If it proves successful, it will have numerous advantages as, owing to its light weight, it will permit the use of standard pole spacing, and with the simplification in this type of construction it will be possible to work on poles carrying live circuits with perfect safety.

Construction in Northern Division

The construction in the northern and central sections is similar to that in the southern division, the same standard specifications applying throughout the whole Public Service territory. Some of the northern section lines are still arranged in a horizontal plane as to phases, but most of the more important lines have been changed to triangular or vertical phase formation to minimize the chance of crosses which would be hazardous because of the enormous amount of energy which would be dissipated in a short-circuit. A ground wire is used on the 13,200-volt lines in the northern division. It is supported on a vertical angle iron electrically connected to the cross-arms. The supports are grounded every fourth pole.

Another installation of aerial cable is made near Newark in passing through the Pennsylvania Railroad yards. To use open work would have required very high towers, which would have been extremely expensive. It was not considered advisable to erect them as the tracks are being continually changed and it is doubtful how long it would be before a tower would have to be moved. Conduit construction would also have been impracticable. Under the conditions aerial cable was employed with 50-ft. pole spacings. The cable contains No. 00 conductors, besides some 250,000-circ. mil conductors, and is insulated like the Camden cable, but it has a lead sheathing inside the jute and steel-tape covering. The cable weighs from 15 lb. to 17 lb. per foot in comparison with 5.5 lb. per foot, the weight of that in the southern division.

Main Office Building

Since the organization of the Public Service Corporation, its main offices have been in the Prudential Life Insurance Building, at Bank and Broad Streets, Newark. The building, which is eleven stories high, is constructed most elaborately from the architectural viewpoint. The exterior is of granite, and the main corridors, halls and assembly rooms are wainscoted in marble. A large variety of electric-lighting fixtures are installed in the building. These serve as an excellent advertisement of the electric company's business.

On the top floor of the building is the main restaurant, while the dining rooms, assembly hall and library are on the floor below. The ninth floor is devoted to executive offices, the eighth floor to law and electrical departments, and the seventh floor to the rest of the electrical department and miscellaneous offices. On the succeeding floors, in the order of their position, are miscellaneous offices, accounting department, general claim department, railway offices, clerical forces, publicity department and showrooms.

There are four high-speed passenger elevators and one freight elevator in the main building and two slow-speed passenger elevators in the extension, where only a three-floor service is required. Three of the four elevators in the main building have a rated carrying capacity of 2500 lb. each. The fourth elevator is of extra heavy type so that it may be used for carrying up safes, parts of vaults and other bulky articles. During the luncheon period from 11:30 to 1 these four elevators carry about 700 persons each way.

New Office Building

Land has been purchased in the center of Newark, facing on Park Place, North Canal and Pine Streets, on which the Public Service Corporation intends constructing a combination street-railway terminal and office building. It will be eight stories high and will cost over $5,000,000. Private rights-of-way have been obtained along which to connect this building with the various lines. The basement will serve as a terminal for cars

approaching through a subway, and the ground floor will be devoted to a combination concourse or station and a commercial office for the gas and electric companies. Elevated cars will have their terminal station on the second floor. The upper floors will be occupied by offices, auditoriums, restaurants, etc.

New Business Activities

The new-business department consists of six divisions having from one to ten district offices, each in charge of one division agent. Each district office is supervised by a district agent, who keeps in touch with local affairs. The division agent acts in a supervisory capacity for the whole division and refers matters of a new-business character to the new-business agent.

Four assistants are employed in the main office at Newark to follow up business throughout the State and plan selling campaigns for all of the offices. In addition, there are three general men who travel around the State in order to assist in following up new-business matters. One of these three men is especially qualified as an "industrial power" salesman, another as a "lighting and sign" man and a third as an "electric vehicle engineer." They visit certain territories at definite times and confer with the local men on special cases along their lines. They sometimes accompany the local salesmen on visits to prospective customers when conferences of a technical nature have to be held. These men act as instructors, on many occasions assisting the local agents on matters requiring more than the ordinary technical ability.

The vehicle engineer acts in an advisory capacity, helping purchasers in the selection of cars and in deciding what types are best suited to certain kinds of work. This man also keeps a list of all battery users in the State and has an inspection of their batteries made periodically. If they are not operating satisfactorily, he advises the user as to the cause and also notifies the manufacturer of the battery. In this way the company aims to keep its customers posted on the proper care of vehicles.

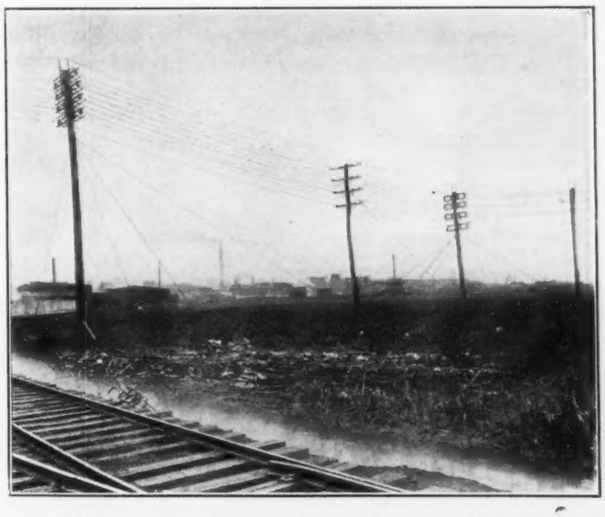


FIG. 38—CURVE AND RAILROAD CROSSING CONSTRUCTION ON 13,200-VOLT LINE

A window decorator is employed regularly to lay out plans for window displays which are sent to the district offices periodically to show how to place appliances so as to get the best advertising effects. The interior display and arrangement of central-station electric shops are also under the supervision of this man.

Some of the offices have been remodelled but in many cases they have been replaced by new buildings which do credit to the system. All of the offices have display rooms.

Advertising matter for distribution among the offices of the entire system is made up in the general office in Newark. Besides the regular addressograph file of

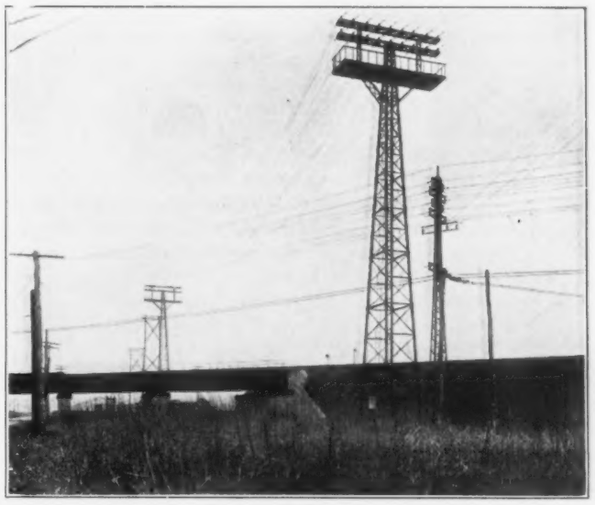


FIG. 39—STEEL-TOWER CROSS-OVER AND EXCHANGE CONNECTION WITH PENNSYLVANIA RAILROAD

customers, the offices have stamped plates bearing the names of non-users of electric appliances. Before every appliance campaign these people are sent attractively illustrated and descriptive booklets on the devices which are being introduced, and in many cases the articles are sold before the demonstrator calls on the prospective customer.

Records revised from time to time are kept of every motor user not connected to the electric-service system, and these prospective customers are visited two or three times a year with the intent of securing their business. The company's men conduct tests on private plants to show how central-station service excels. Designs for motor drive are made without charge upon request of firms contemplating the installation of motor-driven machinery. Special prices exist only during the campaign period and are uniform throughout the State. No apparatus is offered for sale by the company until it is first inspected and has passed the recommendation of its laboratories.

Chief among the industries which are coming to the front as regards the use of electricity is the rubber business. Pottery manufacturers also use considerable central-station energy. The business secured so far this year is about 60 per cent in excess of that obtained up to the same time last year.

Laboratories

Unlike most electric-service companies, the Public Service Electric Company has concentrated its switchboard and meter-testing department and its general laboratories in one department. Here coal and building materials are tested and master standard instruments are tested, calibrated and repaired. Master standard meters are received periodically from each operating division and are tested in the laboratories. The meters are then returned to their respective localities and are used in calibrating working standards. By using master and working standards very little duty falls on the master instrument, and hence its accuracy can usually be depended on.

All switchboard and standardizing instruments purchased by the company are tested in this main laboratory before they are distributed through the system. A card-record system is kept of tests on all instruments, and when a record shows that the accuracy of a certain type of meter varies considerably the period between tests is shortened. Induction-type instruments are tested about once a year, and alternating-current watt-hour meters every six months. Direct-current apparatus is tested oftener. This department also has charge of taking photographs of progress during construction.

Organization

The principal officers of the Public Service Corporation of New Jersey, which is the parent company of the Public Service Electric Company, the Public Service Gas Company and the Public Service Railway Company, are: Messrs. Thomas N. McCarter, president; George J. Roberts, first vice-president; John J. Burleigh, second vice-president; Randal Morgan, third vice-president; Anthony R. Kuser, fourth vice-president; Edwin W. Hine, secretary; H. C. Stevenson, assistant secretary; P. S. Young, treasurer; R. D. Miller, assistant treasurer; T. W. Van Middlesworth, assistant treasurer; Frank Bergen, general counsel; E. A. Armstrong, assistant general counsel; L. D. Howard Gilmour, general solicitor; Edmund W. Wakelee, associate general solicitor; Lefferts S. Hoffman, general attorney; H. V. Drown, general claim agent; Percy Ingalls, general agent; George Barker, real estate agent, and John L. O'Toole, publicity agent. Mr. Dudley Farrand is general manager and Mr. Farley Osgood is assistant general manager of the Public Service Electric Company, and Mr. E. J. Allegaert is general auditor. Mr. N. A. Carle is the chief engineer, having Mr. E. B. Meyer as his assistant, with Mr. N. L. Pollard as electrical engineer and Mr. C. H. Baker as mechanical engineer. Mr. F. W. Casler is the general superintendent of plants, and Mr. G. A. Sawin is meter and illuminating engineer. The division-operating superintendents are: Messrs. William K. Vanderpool, Newark; Rudolph Burkhalter, Orange; William A. LaDue, Hudson; Robert O. Bentley, Bergen; William M. Brock, Passaic; J. T. Barron, central, and Paul Lupke, southern.

The board of directors is composed of Messrs. Thomas N. McCarter, George J. Roberts, John J. Burleigh, Randal Morgan, Anthony R. Kuser, Edwin W. Hine, Frank Bergen, Samuel T. Bodine, Walton Clark, Thomas Dolan, Forrest F. Dryden, P. S. Young, J. Horace Harding, William C. Heppenheimer, Lewis Lillie, Horatio G. Lloyd, Uzal H. McCarter, F. W. Roebling, William Scheerer, P. F. Wanser and Edgar B. Ward.

The members of the executive committee are Thomas N. McCarter, George J. Roberts, John J. Burleigh, Randal Morgan, Anthony R. Kuser, Edwin W. Hine, Walton Clark, Lewis Lillie and Uzal H. McCarter.

Subsidiary Companies

Among the companies leased and operated by the Public Service Electric Company are the following: Paterson & Passaic Gas & Electric Company; South Jersey Gas, Electric & Traction Company; Somerset, Union & Middlesex Lighting Company; Gas & Electric Company of Bergen County; United Electric Company of New Jersey; Middlesex Electric Light & Power Company; Nichols Electric Light & Power Company, Nutley, N. J.; Citizens' Electric Light, Heat & Power Company; Princeton Light, Heat & Power Company; Burlington Electric Light & Power Company; Shore Lighting Company; Passaic Lighting Company; Trenton Gas & Electric Company; Central Electric Company; Citizens' Electric Company; Edison Electric Illuminating Company of New Brunswick; Englewood Gas & Electric Company; Edison Electric Illuminating Company of Paterson; North Hudson Light, Heat & Power Company; Paterson & Passaic Gas & Electric Company; Hackensack Gas & Electric Company; Consumers' Light, Heat & Power Company; South Jersey Gas, Electric & Traction Company; Somerset Lighting Company; Plainfield Gas & Electric Light Company; Boonton Electric Company; Bordentown Electric Light Company; Morris & Somerset Electric Company, Morristown, and Cinnaminson Electric Light, Power & Heating Company.

FIG. 40—NEW GENERATING STATION AT BURLINGTON, N. J.

Central Station Management

Devoted to Discussion of Administrative Policies, Commercial Methods, and Current Practice Among Successful Utilities

Cost of Electric Cooking at Bismarck, N. D.

The Hughes Electric Company, of Bismarck, N. D., furnishes central-station service in Bismarck, Fort Lincoln and Mandan, N. D., and in Glendive, Mont., and has connected to its lines about a hundred electric ranges, energy to operate which is sold at 4 cents per kw-hr. Herewith is given a compilation of the average bills of these hundred customers for ten months, making a mean monthly cost of $2.83 for electric cooking.

March	$3.09	August	$3.82
April	2.09	September	2.88
May	2.89	October	2.74
June	2.54	November	2.04
July	4.04	December	2.18

The Ice Plant Makes Twenty-Four-Hour Electric Service Possible

In a Texas town with a population of 2000, not far from Fort Worth, there is a combination plant containing 75 kw in electrical machinery and a 12-ton ice-making equipment. Last year the revenue received from the ice plant almost equaled that earned by the electric-lighting service, which was $11,800. Together with the sale of supplies, the ice and electric departments earned $23,000 during the year, and the cost of their actual operation for the same period was $13,000. During the year, however, there were incurred a number of heavy replacement expenses incidental to overhauling the plant, and these brought the total outlay for the twelve months up to $19,000, leaving net profits of $4,000. To replace this plant, using good engineering judgment and avoiding, perhaps, some of the mistakes of the original builders, would to-day cost about $40,000, it is estimated. On this basis the combination plant for the year just elapsed earned about 10 per cent on the investment. To have operated the same plant without the ice auxiliary, even for a few hours nightly, would have resulted in a great loss, as the above figures readily suggest. The addition of the ice plant, however, has made possible the furnishing of electric service twenty-four hours a day, instead of for the minimum hours nightly, and has, moreover, enabled this improved all-day electric service to be rendered at a fair profit to the company.

Sales Department Holds Electric Dinner

Increased activity in all branches of the sales department of the United Electric Light & Power Company, New York, has recently required the addition of a number of new men. With the idea of getting these men acquainted with the older men of the staff, and to familiarize them all with the company's latest plant-operating methods, a tour of inspection was made through the new 201st Street station, after which an electrically cooked dinner was served on the plant-office floor. The dinner was prepared by a local caterer, who used a 6-kw electric range and a 2-kw oven set up temporarily at the station in the chemist's laboratory. The menu was as follows: Grape fruit, cream-of-celery soup, filet of beef with mushrooms and fried potatoes, Roman punch, roast chicken with mashed potatoes, salad, ice cream, coffee and cigars. The oven was also used to heat the dishes preparatory to serving the dinner. About forty sat down at the table. Among those present were Messrs. Frank W. Smith, vice-president; W. E. McCoy, electrical engineer; Joseph F. Becker, sales manager, and H. W. Leitch, plant superintendent. Brief talks were given by the vice-president and the sales manager.

PREPARING AN "ELECTRIC" DINNER

Chicago Company Advertises in Many Daily Papers

Mr. H. A. Seymour, editor of the *Edison Round Table*, published by the Commonwealth Edison Company Section of the N. E. L. A., Chicago, speaking of the newspaper advertising of the company, recently made the statement that the Commonwealth Edison Company is an almost constant advertiser in ten of Chicago's daily papers and in addition uses twenty-six foreign weekly papers within the city and thirty-six other weekly papers which are published outside of Chicago. Extensive and continuous advertising, said Mr. Seymour, has been an important factor in the upbuilding of the company's business.

New Business Offices at Warren, Ohio

While the Trumbull Public Service Company at Warren, Ohio, was undergoing the constructive development described in the *Electrical World* of Jan. 24, 1914, the local organization worked under the handicap of an inadequate office. Recently, however, the company has

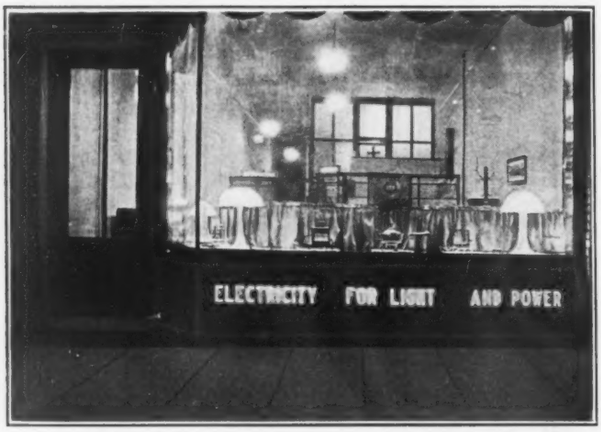


FIG. 1—SHOW WINDOW IN WARREN OFFICE OF TRUMBULL PUBLIC SERVICE COMPANY

moved its headquarters into a new building on the public square amid inviting surroundings. Accompanying illustrations show the interior and exterior of the new office.

Part of the front of the office is used as a display space for appliances. The office of the new-business manager, Mr. W. J. Marshall, is situated near the doorway, the idea in so locating it having been that by frequently seeing each other the new-business manager and the public will become better acquainted. In addition to maintaining a well-lighted show window, the company has utilized to advantage the space below the window by placing there a transparent sign reading "'Electricity for Light and Power," behind which six 150-watt tungsten lamps supply illumination. The interior

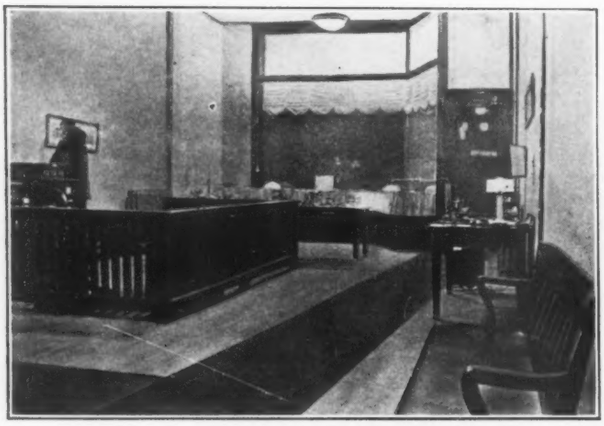
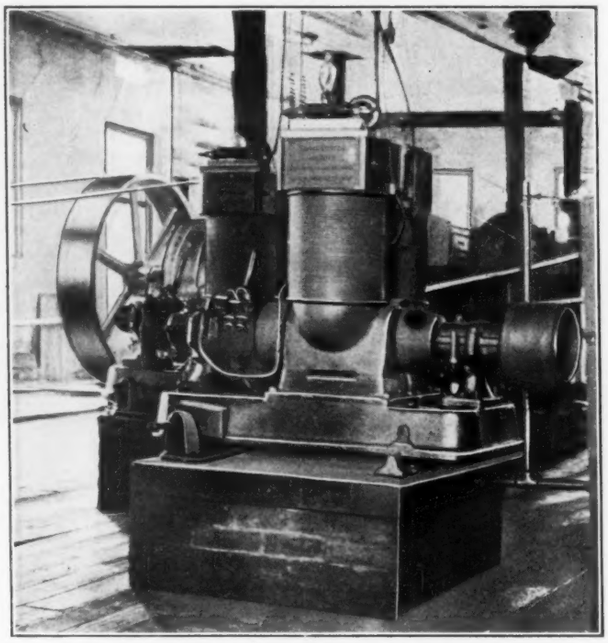


FIG. 2—INTERIOR OF ELECTRIC-SERVICE OFFICE AT WARREN, OHIO

of the main office is lighted by means of three 500-watt tungsten lamps inclosed in diffusing reflector bowls. Semi-indirect fixtures containing four 150-watt lamps are used to illuminate the private office of Mr. George Daugherty, local manager of the company. Thus the whole arrangement and lighting equipment of the office is of the "up-to-the-minute" kind.

Edison Bipolars in Service Twenty-Eight Years

In the central station at Mount Holly, N. J., are four 25-kw, 125-volt Edison bipolar generators which were installed in 1886 and have been in continuous operation ever since. This installation was the sixth of its kind in the United States. Although the machines are oper-



BIPOLAR GENERATOR INSTALLED IN 1886 AND STILL IN USE

ating practically as well as the day they were installed, they will soon be replaced by modern transforming apparatus fed from the lines of the Public Service Electric Company of New Jersey. The machines are driven in pairs by two simple horizontal steam engines. Each pair is connected in series to feed a three-wire distributing system.

Cleveland Conference on New-Business Methods

Under the energetic chairmanship of Mr. Thomas F. Kelly, of Dayton, the committee on new-business cooperation of the Ohio Electric Light Association held its third public meeting on May 22 at the Hotel Statler, Cleveland. Mr. Kelly presided and Mr. George S. Milner, president of the Electrical League of Cleveland, which gave the recent successful electrical exposition in that city, welcomed the visitors. Mr. Milner spoke of the spirit of co-operation among the electrical men of Cleveland under the leadership of the Cleveland Electric Illuminating Company. Mr. D. L. Gaskill, of Greenville, secretary of the Ohio Light Association, spoke briefly, saying, among other things, that Cleveland is the second city in the United States in electrical development. Mr. Kelly said the work of the committee is intended particularly to benefit the smaller companies. One plan is to employ a new-business promoter to go from one town to another, spending perhaps a month in each, the expense to be borne jointly by the companies benefited.

Business-Getting Campaigns in Cleveland

Mr. M. E. Turner, contract agent of the Cleveland Electric Illuminating Company, described, with the aid of pictures thrown on a screen, the effective new-busi-

ness campaigns adopted by that company to supplement the regular work of the contract department. There are three of these campaigns, one devoted to the wiring of old houses, one to the wiring of small stores and one to securing large motor business. The wiring campaigns have been notably successful, particularly the house-wiring propaganda. Both newspaper advertising and direct mail advertising are used. In the house-wiring campaign a list of about 6000 prospective customers was secured in the spring of the years 1912, 1913 and 1914. To each of these five pieces of mail matter were sent. At the end of the first year 12 per cent of the houses were wired, which was considered an excellent record. The next year the list was revised to bring it up to 6000 again, and at the end of the second year's campaign 20 per cent of the houses were wired. This year's campaign has just been started, but it is believed that at the end of it 33⅓ per cent of the 6000 prospects will have been secured.

The houses on the list of "prospects" are not picked houses by any means, but are scattered all over the city. They are old houses on the company's lines now using some other form of illuminant than electricity. A flat rate per outlet is charged. The customer receives ten months in which to pay, and a deduction of 15 per cent is applied on lighting bills. The business is turned over to wiring contractors. During the last eight years 9335 old houses have been wired in Cleveland. In the house-wiring campaign printed letters are sent out. There are three series of these, one for householders owning and living in their own homes, one for tenants and one for landlords. These letters vary slightly. With the last one a booklet is sent out entitled "Electric Wiring of Old Houses." This booklet tells householders in simple language how to make up their own wiring estimates, based on the number of outlets. A similar booklet printed in Bohemian illustrates the practicability of electric light for the workingman's home. Newspaper advertisements are run at the same time.

In relation to the wiring of small stores the methods employed are similar, although it is more difficult here to make a flat rate per outlet. However, an average has been figured out. The printed matter in this case consists of a series of booklets or folders rather than letters. These folders are convincingly and concisely written. One of them gives a blank schedule or table which may be filled in by the prospect to show the outlets desired. A booklet entitled "Electric Wiring of Small Stores" is sent.

Special solicitation of large power users was begun on April 8 of this year. The method in this campaign is to print daily-newspaper advertisements in the form of interviews with heads of industrial establishments taking the company's service. First, a map of Cleveland was printed in this series of advertisements. On this map the principal generating stations, substations and distributing lines in the industrial area were indicated. In subsequent advertisements accurate and authorized interviews with prominent industrial customers were printed, the name of the man interviewed and his company being given in each case. Many of these interviews make very interesting reading. Some of the important concerns supplied with electric energy for industrial purposes, and contributing interviews, were the Hydraulic Pressed Steel Company, Perfection Spring Company, Standard Tool Company, Acme Foundry Company, Baker Motor Vehicle Company, General Baking Company, Ferro Machine & Foundry Company, Ohio Clay Company and Cleveland Salt Company. Mr. Turner pointed out the weight carried by these authorized interviews from men well known in the industrial world. A series of carefully written personal typewritten letters is addressed to prospective motor-service customers while this newspaper advertising is being published.

Bureau of Standards and Public Utility Regulation

At a luncheon between sessions Dr. Frank A. Wolff, of the National Bureau of Standards, told of the work of that institution. Among other things, he said that a sub-committee of the national commission on electrolysis is about to leave, or has left, for Europe to study conditions there. An investigation of life hazards incidental to electric transmission is under way. Secretary Redfield of the Department of Commerce has proposed that the Bureau of Standards make a study of the fundamentals underlying public-utility regulation, taking the broad national point of view. This study might serve to bring about the co-operation of states and state public service commissions. Indirectly it might be of service in fixing standards for the qualifications of public utility commissioners.

European Central-Station Practice

Mr. S. E. Doane, of Cleveland, chief engineer of the National Lamp Works of the General Electric Company, gave an illustrated talk on "European Central-Station Practice." One point made by some of the foreign companies which Mr. Doane visited (referring to the desirability of getting very small customers) was that every man who votes for a franchise for an electric-service company is entitled to service at a rate he can afford to pay. The small customer must be financed. In Europe the companies that go after small customers seem to pay satisfactory dividends.

Mr. Doane illustrated and described several of the small and inexpensive flat-rate limiting devices which are used with the small-customer service in many European cities. In the discussion Mr. Kelly, of Dayton, said that a limiting device had been tried in Xenia, Ohio. By using it business was secured which would otherwise have been hard to get. The device has given little or no trouble and seems to be successful in that small city. Mr. Kelly mentioned the fact that in Dayton there is an electric meter to every nine inhabitants. Mr. J. C. Martin, of Wilmington, president of the Ohio Electric Light Association, was introduced and spoke briefly.

Illumination as a Business Getter

Mr. E. B. Rowe, of the Holophane Works of the General Electric Company, Cleveland, gave a talk on "Illumination as a Business Getter." Among other things, Mr. Rowe spoke of the almost spectacular street-car lighting of the Toledo Railways & Light Company. Every car is an advertisement for effective illumination. Another point made by the speaker was that by the use of the new gas-filled lamp it might be possible for contractors doing large jobs of construction work to carry on their operations at night as well as in the daytime. In the discussion Mr. Kelly dwelt on the great opportunity for show-window lighting in small towns. He made the interesting statement, in relation to country-highway lighting, that the Dayton company has completed an installation for lighting a stretch of country road, using thirty 75-watt tungsten lamps. Two other installations of this character are planned. The matter was handled through the township trustees. The people living along the road were required to furnish a certain number of house-lighting contracts in order to get a certain number of lamps for lighting the highway. Mr. E. A. Bechstein, of Sandusky, told about a plan for flat-rate show-window lighting, where the circuits are controlled from the switchboard of the central-station company.

Illumination and Wiring

Fountain Sign

Illustrated herewith is an electric sign advertising one of New York's vaudeville houses and designed to represent water spouting out of a fountain and trickling down the center and each side of the illuminated display board. The sign consists of two panels which can be viewed from any place on the street in the vicinity. Surmounting the display board is an imitation fountain from which water is made to appear to spout by lamps supported on arched streamers. The upper part of each display panel bears the permanent advertising text, while the lower section is devoted to changeable texts telling of the programs given in the theater. The sign and flashing mechanism were furnished by Mortimer Norden, New York.

B. F. KEITH'S COLONIAL THEATRE HIGH CLASS VAUDEVILLE
GERTRUDE HOFFMAN
B. F. KEITH'S COLONIAL THEATRE HIGH CLASS VAUDEVILLE
GERTRUDE HOFFMAN

FOUNTAIN SIGN ON NEW YORK THEATER

Automatic Fuse-Testing Machine

BY HERBERT G. DORSEY

When it is necessary to determine the quality of a large number of fuses considerable time is consumed if the ordinary method of testing is followed. For example, the National Board of Fire Underwriters in its 1913 edition of rules says "they will carry indefinitely a current 10 per cent greater than that at which they are rated, and at a current 25 per cent greater than the rating they will open the circuit without reaching a temperature which will injure the fuse tube or terminals of the fuse block." As these tests may require for different fuses as much as two hours for each fuse, it is evident that if several similar fuses are to be tested at once it will require no longer time to test all than that necessary for the slowest acting fuse, provided one has the ability to make all the records of time and temperature.

Fig. 1 is a photograph of a testing board which was designed to give records for fifteen fuses. The principle of operation is as follows:

The fifteen fuses being in series, the desired current passes through all of them. If any fuse operates, that fuse holder is short-circuited so that the current continues to flow through the remaining fuses, the circuit being open for only a small fraction of a second. When a fuse is inserted in the circuit a stop-watch begins to operate and continues to record time until the fuse operates. The act of short-circuiting the fuse also stops the watch. Back of each fuse is a thermocouple, and the connections are such that a sliding switch at the left-hand side of the board will connect any thermocouple to the galvanometer, and the temperature of any fuse may be measured.

Details of Construction

Fig. 2 shows a plan of a single-fuse, thermocouple and short-circuiting device. 1 is the fuse cartridge in its terminal clips 2 and 3. 4 is a strip of hard copper ¾ in. wide by 1/16 in. thick so placed that in its normal position it is in contact with 3 and the fuse is short-circuited. When spring 4 is pushed up by handle 6, the circuit opens at 3 and 4, the current flows through the fuse, and at the same time steel part 5 slides past the end of the relay armature 7. This steel piece 5 is only a terminal to 4 to prevent the latter from wearing. Armature 7 then locks spring 4 open and also closes contacts 9 on the relay. By following the diagram of connections in Fig. 3, it will be noticed that the relay coil 8 is shunted across the fuse terminals. If now the fuse operates, the full voltage of the circuit will pass through the relay 8, attracting armature 7, which releases spring 4, short-circuiting the fuse terminals and cutting off the current from the relay. At the same time the armature 7 opens the circuit through the contacts 9 and the watch magnet is no longer energized, thus stopping the watch.

Watches

Fig. 4 shows how low-priced watches were converted into electric stop-watches. The magnet 10 was made of a small U of No. 14 soft iron wire wound with about 200 turns of No. 40 B. & S. gage black-enameled wire. Armature 11 was a small, thin piece of soft iron soldered to a phosphorous-bronze wire 12 which had been hammered flat at point 13 before being soldered to its support 14. This wire was No. 30 B. & S. gage and was bent at right angles over the balance wheel of the watch so that when the magnet is not energized the wire touches the balance wheel, stopping the watch. When the magnet is energized the wire is drawn away from the balance wheel, at the same time giving it a slight motion so that the watch runs as long as its circuit is closed. The thin brass frames holding the magnets and armatures were soldered on the watch plates near the main spring pinion with low fusing solder and the case lids were cut away so that a circular cup could be soldered in. This allows the watch to be closed up with the exception of a small hole in the middle

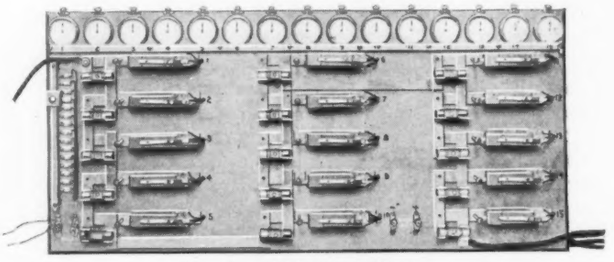


FIG. 1—TESTING BOARD

through which was passed one end of the magnet winding, the other end being grounded on the magnet frame. In a recess cut into the board the watches are held by a screw passing through the ring, which is turned back over the top of the board, and by a long thin brass strip at the bottom, as shown in Fig. 1. This brass strip being in contact with all the watches serves as a com-

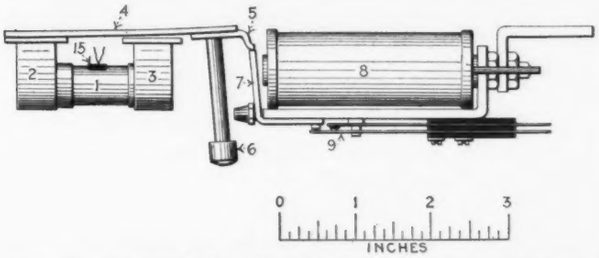


FIG. 2—SINGLE-FUSE, THERMOCOUPLE AND SHORT-CIRCUITING DEVICE

mon return circuit for all their magnets. These magnets average about 33 ohms each, and the total current required from a single storage cell when all are operating is about 1 amp. The watches are heated only a slight amount by this current. The watches are easily wound and reset by the stems, which project above the board. The second hands can of course be reset only by closing the circuit until the second hand is at zero.

Relays

The relays are regular telephone relays of 500 ohms resistance which open one pair of contacts when the armature is attracted. Being of such high resistance, the current shunted from the fuse is negligible, and when the fuse opens its circuit the relay operates almost instantly on either alternating or direct current. Even with 220 volts, it would be several minutes before they would burn up in case the short-circuiting device should fail.

Thermocouples

The thermocouple back of each fuse was composed of copper and German silver wire, the only reason for using these metals being that they were the most easily obtainable at the time. The two wires were soldered together to a small piece of thin copper about ¼ in. square and were bent in such a manner after they came through the board that this piece of copper rested against the fuse tube. The copper, being bent to the same curvature as the fuse tube, made sufficient contact to attain the temperatures of the tube very quickly and gave readings more reliable than can be obtained through the ordinary mercurial thermometer. All of

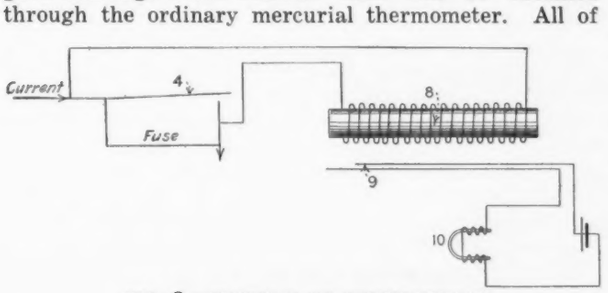


FIG. 3—DIAGRAM OF CONNECTIONS

the German silver wires were led to a common point, which was connected to the copper wire leading to the sliding switch at the left of the board as shown in Fig. 1. The extra wires of the thermocouples were led to the individual contacts of the switch so that as the slider was moved along the square bar which formed its support it in turn made contact with any one of the thermocouples. Of course, the temperature as thus determined is only the difference between the fuse temperature and that of the room, but as the latter was taken as the zero point in calibrating the thermocouples, the indicated temperatures of the fuse would be its actual temperature plus or minus however much the room temperature had varied from its time of calibration. Excepting in cases of extremes of room temperature, this difference is too slight to be of importance in fuse testing.

Results

The operation of this testing outfit has proved very satisfactory during the few months it has been in use. Many hundreds of fuses have been tested and the time saved is very great. After the fuses are inserted, the relays set and the current turned on, it is only necessary then for an assistant to watch the ammeter and regulate the rheostat occasionally when the supply voltage varies to keep the current constant. Whenever a fuse operates its temperature is taken by reading the galvanometer. After all the fuses have operated the times are recorded and a new lot of fuses inserted. If a large number of the same capacity are to be tested as

FIG. 4—METHOD OF CONVERTING ORDINARY WATCH INTO ELECTRIC STOP-WATCH

soon as the first one operates, its watch may be reset, a new one inserted, and the process continued until all are tested.

Although this fuse-testing outfit was built for a total of fifteen fuses, it is evident that it could be extended to any reasonable number, or the same idea could be used for two or three fuses if one cared to build it for such a small number.

If larger fuses were to be tested, of course the parts would have to be much heavier in order to stand the greater current, and if many fuses of high amperage-carrying capacity were to be tested, a low voltage would be desirable in order to economize energy. The winding of the relay would have to be of lower resistance so that it would operate on a lower voltage when the fuse burned.

The testing board is mounted at a convenient height and at a safe distance from the wall like a switch panel. Above are mounted large rheostats and below are smaller ones which may be thrown in series or parallel, so that on a 220-volt circuit any current from 1 amp to 50 amp may be obtained. Thus the apparatus is available at any time for fuse testing, and without the fuses the circuit is ready to supply any current up to 50 amp for experimental purposes.

Letter to the Editor

Resistivity on Trial

To the Editors of the Electrical World:

SIRS:—"Resistivity," alias "volume resistivity," alias "mass resistivity," alias "X resistivity," is on trial—or shall we say are on trial? The case against "resistivity" is ably presented in Circular No. 31 of the Bureau of Standards, which should be read by everyone interested in the subject, and when quoting the definitions of resistivity there given it should be clearly understood that this is done merely for the sake of exposition and not in criticism of that most valuable discussion or of its most important features. We are here concerning ourselves with the questions of what resistivity is and whether the term "resistivity" shall stand for a general idea comprehending the so-called volume resistivity and the so-called mass resistivity or whether the term shall be restricted to the meaning of the so-called volume resistivity.

The definitions for resistivity given in Circular No. 31 are descriptive rather than precise. For instance, it is there stated that "Resistivity is definable in the most general way as the resistance of a unit specimen." Such a definition is objectionable, because it is liable to the interpretation that resistivity is a resistance. From this point of view the definition is inaccurate in the same way as it is inaccurate to state that density is the mass of a unit volume, whereas it is preferable to say that density is the mass per unit of volume. Of course density can be measured by the mass of a unit volume just as resistivity can be measured by the resistance of a unit specimen, but there is no necessity for suggesting in the definition that resistivity is a resistance. Further than this, the definition for resistivity above quoted is inadequate, as it is evidently necessary to know more of what is meant by "a unit specimen." The resistance of a unit specimen may be of any value whatever unless the form or configuration of the unit specimen is specified, in addition to having an understanding as to the surfaces between which the resistance is measured.

In another place it is stated that "Resistivity is simply the property of unit *quantity* of a substance." This, of course, cannot be taken as a serious definition of resistivity, for resistivity is a property of the substance itself and is not dependent upon the unit quantity of it, although a unit quantity, when other conditions are given, may be employed for measuring the resistivity.

What then is resistivity? Without attempting a formal definition, the idea of what resistivity is may be approached as follows: The resistance of a circuit depends on the length of the circuit, the cross-sectional area across the circuit, and a certain innate property of the substance composing the circuit. It is this innate resistance-determining property which is generally known as resistivity. Resistivity in this sense is an innate property of the substance which determines the resistance of a circuit, the other determining factors being length and cross-sectional area.

Now, are there any other kinds of resistivity? For instance, instead of selecting length and cross-sectional areas as two of the factors determining the resistance of a circuit, can one select either mass and length or mass and cross-section and consider the remaining resistance-determining factor as a kind of resistivity?

That this might be done in the case of linear circuits of uniform cross-section may be shown as follows:*

*The analogy here given between resistivity in its customary sense and the other two so-called kinds of resistivity breaks down for other forms of circuits. The so-called mass resistivity and X resistivity are of restricted usefulness.

For (homogeneous and isotropic) linear conductors of uniform cross-section we have the two fundamental equations

$$R = \rho \frac{l}{s} \tag{1}$$

$$d = \frac{m}{ls} \tag{2}$$

ρ being the so-called "volume resistivity" and d the density. If equation (2) be used to eliminate s from equation (1),

$$R = \rho d \frac{l^2}{m} = \delta \frac{l^2}{m} \tag{3}$$

where δ (or ρd) is the so-called "mass resistivity." Similarly, if equation (2) be used to eliminate l from equation (1),

$$R = \frac{\rho}{d} \frac{m}{s^2} = X \frac{m}{s^2} \tag{4}$$

where X (or $\frac{\rho}{d}$) is a kind of resistivity to which no name has been given. It is related to a gram mm² standard of a substance in the same way that the volume resistivity is related to the "meter mm²" standard and the mass resistivity is related to the "meter gram standard."

Although there appears to be no demand for a term corresponding to this X resistivity, yet it seems to have a right to exist in much the same way as the term "mass resistivity" is justified. If instead of metallic wires we were accustomed to deal with metallic sheets conducting from face to face, then X resistivity would have suggested itself instead of "mass resistivity."

An inspection of equation (1), (3) and (4) might tempt one to name, for convenience, these three kinds of resistivity respectively: Resistivity (ρ); density resistivity, ($d\rho$); per density resistivity $\frac{\rho}{d}$.

There are a good many reasons why these terms are not satisfactory, but it is helpful, just for the moment, to think of them in that way. It is to be noted that the factor density d, like ρ, is an innate property of the substance itself. Therefore ρ, $d\rho$ and $\frac{\rho}{d}$ are all innate properties of the substance. Also they are all quantities of a kind similar to ρ. (They are all point-functions and of the same type as ρ since d is always a *scalar* point-function.) Therefore there is some justification for classing them under one common term.

Nevertheless, it must be admitted that the use of the term "resistivity," in an extended sense, is unsatisfactory. It would seem preferable to retain the term "resistivity" in its most widely used significance, as referring to "volume resistivity," and invent an entirely new term for "mass resistivity." For instance, it might be termed "resistation," not because that it is a very good term for it, but because it is better to give it almost any distinctive name rather than have confusion introduced by using the well-established term resistivity in an ambiguous sense. The ambiguous use of the term resistivity would compel the use of the cumbrous term "volume resistivity" for a definite idea of frequent occurrence and of wide application which has heretofore been represented by the concise and well-established term "resistivity."

Custom and usage, as an argument against any change for the better, should not have any more consideration than is absolutely necessary, but in the case of resistivity there is but one well-established meaning for the term and there is no sufficient warrant for the meaning to be changed.

Perth Amboy, N. J. TRACY D. WARING.

Field of the Operating Engineer

A Record of Practice, Experience, New Ideas and Interesting Problems—Notes on Practical Subjects—Questions and Answers

An Oil Can That Failed to Lubricate

A 100-kw induction regulator had been in uneventful and satisfactory operation on the circuits of a certain Southern power plant for about eight months when suddenly and without warning it burned out When the rotor was removed for inspection, one coil was found badly charred, but attention was attracted by a long worn place which extended part way around the rotor structure. Searching in the dark depths of the stator tank for the cause, a badly mashed oil can was finally brought to light, the can having evidently fallen into the machine while on the erecting floor at the factory. The remains of the oil can bore the initials of its former owner, and the manufacturer when communicated with was able to place the guilt for the accident and promptly furnished the customer with a receipted bill for the repairs to the apparatus.

New System of Battery Charging for Garages

At the recent annual meeting of the Chicago Section of the Electric Vehicle Association Mr. D. M. Simpson, engineer for the Electric Storage Battery Company, gave an illustrated talk descriptive of the new garage system of constant-potential storage-battery charging for lead batteries. By this system the battery is put on charge normally at 2.3 volts per cell without any resistance in the circuit. The current draft is heavy at first, but tapers off automatically, the battery taking energy at all times in proportion to the lead sulphate in its plates. This system, which is spoken of as practically automatic, was referred to by Mr. Simpson as a valuable improvement in the practical operation of charging stations for electric vehicles.

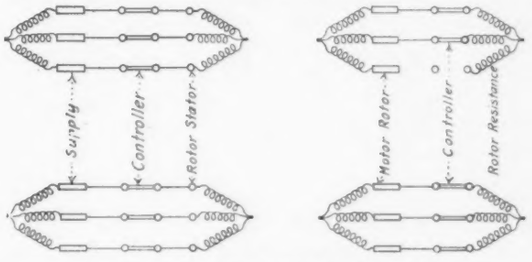
The system is not adapted for use in private garages charging only one or two cars, owing to the high rate of current demand during the first few minutes of the charge. This would increase the maximum-demand charges per kilowatt-hour. However, in garages charging a large number of cars, putting the individual cars on charge at intervals enables the operator to reduce the maximum demand of the plant lower than that required by the old system of charging. This is due mainly to the fact that the few cars put on charge during the earlier part of the evening will be practically charged and taking current at a very low rate about midnight when the greatest number of cars are being charged. Also, those cars coming in the garage after midnight can have the greater part of the charge restored before the usual time for delivery of the car to the customer. In this, as in all other cases, the weekly "equalizing" or "overcharge" must not be omitted.

It is claimed for this system that there is some saving of energy, the amount depending on the character of the plant. It is also said that batteries under this method of charging will have a longer life. This is perhaps to be expected, as by this system excessive gassing is avoided, and without excessive gassing the temperature of a battery in good condition will not, it is said, go more than 15 deg. above the temperature of the room.

In garages using motor-generator sets the desired voltage may be changed by adjusting the field of the generator. Where direct current is obtained from a 110-volt circuit the desired voltage may be obtained by the use of counter cells.

Starting-Torque Control

The torque of a given slip-ring polyphase induction motor depends, among other things, upon how many of the rotor circuits are completed through the brushes and resistor. The starting torque is greatest when all of the rotor circuits are active, the circuits under this condition being said to be balanced. Ordinarily any controller used for operating an induction motor closes the stator circuits on the first marked controller position, as indicated in both Figs. 1 and 2. On the next marked controller position the controller closes the circuit through either two of the rotor coils and corresponding resistors of a three-phase motor or through three of the rotor coils and corresponding resistors, as



FIGS. 1 AND 2—WIRING DIAGRAMS

indicated respectively in Figs. 1 and 2. In the first case the rotor circuits are said to be unbalanced. The balanced connection gives greater starting torque than the unbalanced connection. This fact affords an easy method of increasing or of decreasing starting torque, if the proposed change happens to be in the right direction. An inspector had to decrease the starting torque of a motor that was starting a winding drum too suddenly. At the time of installation everything was stiff; the voltage was normal and the starting impulse was right. It had been gradually increasing both on account of the connected load having limbered up considerably and on account of added service transformers having increased the applied voltage. As it was undesirable to change either the winding gears or the voltage and as all of the rotor resistance available was in use, the inspector changed the resistor wiring from the balanced connection of Fig. 1 to the unbalanced connection of Fig. 2. The change gave about the desired result and had the advantage of being easy to change back again should decrease in the service voltage ever make such a change desirable. In this and in similar cases an open circuit in the rotor is used to advantage, but its effect does not extend beyond the first controller notch. In case of an open circuit due to a fault, however, the effect would be active on all notches and the full torque possibilities of the motor would not be realized.

Locating High-Tension Trouble with Exploring Coil

Locating punctured insulators which do not allow sufficient current to flow to trip circuit-breakers, but only enough to demoralize telephone service in a community, is a pastime at which many central-station employees have put in weary hours. Recently, however, the Iowa Railway & Light Company, Cedar Rapids, has discovered that on its delta-connected 33,000-volt system such trouble may be traced by using an exploring coil attached to the ordinary head-type telephone receiver. Proceeding along the line from the power station, the troubleman merely places the coil against each pole, wearing the receiver on his head, and if the pole is noisy then tries the next. In this manner the entire line is patrolled until the troubleman passes a point at which the telephone receiver and the exploring coil detect no sound. This gives the information that the seat of the trouble rests upon the last pole visited. In speaking of the company's experience with the system. Mr. John M. Drabelle, electrical engineer, says that the scheme has been quite successful, enabling the company to trace such insulator failures with much greater speed and surety than with any other method.

Economical Working of Steam Plants

The following extracts from a paper on "Mill Steam Plants" read by Mr. A. G. Hosmer at the ninety-sixth annual meeting of the National Association of Cotton Manufacturers at Boston, Mass., are of interest to central-station operators and power engineers.

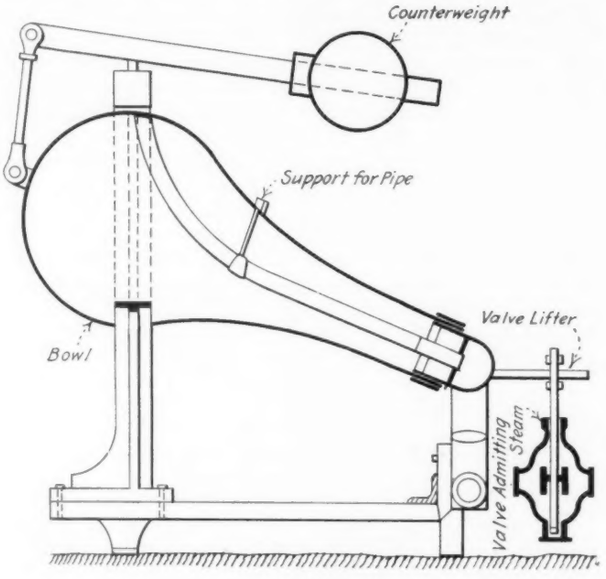
Operating boilers below their rating may be conducive to long life and low repairs, but such practice means the loss of the economies due to high-duty service. In a typical water-tube boiler where additional power was needed in a plant affording no space for more equipment the steam output was more than doubled by the installation of a grate having about twice the area of the original unit. Only a slight drop in efficiency resulted during the maintenance of the intense fires required. Forced or balanced draft is particularly useful in utilizing cheaper grades of fuel, as any intensity of air pressure can be obtained, and in one plant familiar to the author it has proved of great assistance in handling the harder grades of bituminous coal which are burned with difficulty in furnaces having a moderate natural draft.

A boiler operating at 175 lb. pressure, having a temperature of about 380 deg., cannot be exposed to gases cooler than about 400 deg. without losing heat. Temperatures much less than 100 deg. higher than the boiler surface are inadvisable. An economizer is therefore useful in saving heat between boilers and chimney. The idea that a high temperature in the flue is indicative of excessive waste is pretty well dispelled by the efficiency shown by boilers under test with gases leaving them at 600 deg. or 700 deg.

Where pure condensing water is available, a great improvement can be made in a mill plant by installing surface condensers and piping the circulating water directly to the dye house or converting departments. By substituting this water for the usually cold supply, which seldom exceeds 40 deg. in winter, a gain of 70 deg. to 80 deg. in temperature can be realized at once, according to the vacuum required. A warm-water system of this kind supplied by a surface condenser can be drawn upon for feeding the boilers and, on account of the entire absence of oil from the engines, is much superior to the discharge from a jet condenser, which is often used for this purpose. The allowable depth of a furnace which can be successfully fired by hand is about 8 ft. An expert fireman can, by carefully retaining the fresh coal in front of the clear fire while the volatile matter burns away, greatly reduce the amount of smoke.

Remedying Operating Trouble with Steam Trap

A tilting steam trap on the heating system of the Springfield (Ill.) Light, Heat & Power Company formerly gave considerable trouble owing to breaks occurring on the drain elbows and on the drain pipe itself.



TILTING STEAM TRAP

Constant jarring of the long unsupported drain pipe was thought to be the cause of the trouble. Accordingly the bowl was tapped and a supporting member suspended from the shell of the bowl at about the middle of the drain pipe. After the hole which had been bored in the shell was plugged the trap was replaced in operation and since has given no trouble.

Variation of Inductance with Size of Conductor

The inductance of a circuit consisting of two No. 10 wires spaced 18 in. is greater than that of a circuit of No. 1 wires spaced the same distance. What causes this difference if the actual difference in the areas will not account for it? H. M.

The inductance of the circuit of No. 10 wires is greater than that of the No. 1 wires because for any chosen amount of current in the wires a greater number of lines of force is produced between the wires when the diameter is small than is true when the diameter is large. At any given distance from the center of the wire the current in the conductor produces around the conductor a magnetic field which varies in density inversely with the distance from the center of the conductor carrying the current. The flux within the area of the conductor drops off from a relatively high value at the circumference to zero value at the center. When a conductor of small diameter carrying a certain value is substituted for a conductor with large diameter carrying the same total amount of current, the total flux surrounding the current is greater when this current is concentrated in the small conductor than it is when spread out over the large conductor.

Digest of Current Electrical Literature

Abstracts of Important Original Articles Appearing in the Periodical Electrical Press of the World

Generators, Motors and Transformers

Polyphase Commutator Machines for High Speed and Low Frequency.—VERDURAND.—A paper read before the International Society of Electricians in Paris. Polyphase commutator generators yield alternating currents of low frequency at high speeds; for instance, while in order to produce an alternating current of fifty cycles with ordinary alternators the speed must not be over 3000 r.p.m., it is possible to get currents of that frequency from a commutator alternator at speeds of the order of 10,000 r.p.m. Since the weight and size of a machine vary approximately in reverse ratio with the speed, the possibility of using high-frequency machines is of importance. The author shows that the field of commutator generators revolves with a speed which can be regulated simply by modifying the phase of the exciting current. Such generators are self-exciting. When such machines are loaded a variation of frequency is produced which is proportional to the load current and also depends on the power-factor of the circuit; but this factor can be rendered negligible by proper design, at least for normal frequency.—*Bull. Soc. Internat. des Elec.*, March, 1914; *Revue Elec.*, May 15, 1914.

Commutation.—ARTHUR MANDL.—The author discusses the conditions of commutation of a direct-current motor with interpoles at normal speeds. He determines experimentally the air-gap flux below the interpole and shows that if the commutation is to be good there must exist a real flux passing through the air-gap. If the air-gap below the interpole is free from any flux, we have the case of an exact compensation of interpole and armature ampere-turns and the commutation is considerably below normal.—*Elek. u. Masch.* (Vienna), May 10, 1914.

Armature Winding with Two Commutators.—A note on the conditions under which the voltages at the two commutators become equal with reference to a recent paper of Pichelmeyer.—*Elek. u. Masch.* (Vienna), May 17, 1914.

Generation, Transmission and Distribution

Gas Power Plant.—An illustrated article on the electric equipment of the power plant of the Metallurgical company of Pont-à-Vendin. The old equipment comprises three 800-kw generators driven by gas engines operated on coke-oven gases. The company is now erecting eight blast furnaces, each producing 250 tons of pig iron per day, also an open-hearth plant and a Bessemer plant with five converters. For the present only three blast furnaces and three converters will be installed. The new electric-power plant contains five gas engines all driven by blast-furnace gases. Three of them drive generators of 2800 kva each and two alternators of 5600 kva. The pressure is 5000 volts and the frequency fifty cycles.—*La Revue Elec.*, May 15, 1914.

Induction Regulators.—ZEDERBOHM.—The author points out that in order to keep the voltage constant in extended transmission systems rapid regulators must be provided in the power plant, besides induction regulators (drehtransformatoren) at the main feeding points. The principle of the induction regulator, its mechanical construction, the automatic method of voltage regulation, and the maintenance of the regulator are described by means of diagrams and illustrated by examples.—*Elek. Kraftbet. u. Bahnen*, April 14, 1914.

Traction

Mountain Railway.—W. GYAROS.—An illustrated article on the equipment of the Überetscher road near Bozen, in Southern Tyrol, with a 1200-volt direct-current system. The road has considerable grades. Three-phase energy is transmitted at 10,000 volts from the power plant to a substation near the center of the road where direct current at 1200 volts is generated. The equipment of the substation, overhead line, rolling material, etc., is described and illustrated.—*Elek. Kraftbet. u. Bahnen*, April 14, 1914.

Constantinople Street Railway.—An article on the opening in 1913 of the first portion of the electric street railway in Constantinople. The energy is obtained from a combined lighting and traction station in the form of three-phase energy at 9600 volts. This is changed into 600-volt direct current in three substations.—*Elek. Kraftbet. u. Bahnen*, May 14, 1914.

Installations, Systems and Appliances

Electricity Supply in Paris.—According to the former system of electricity supply, Paris was divided into six districts, each of which obtained energy from a station in the district and on a system which as often as not differed from that in the adjoining districts. The systems employed were continuous current of the five-wire type at 440 volts, continuous current of the three-wire type at 220 volts, and continuous current of the two-wire type at 110 volts. There was also the alternating-current system of the single-phase type at 3000 volts with transformers on the consumers' premises, and a two-phase supply, the two last being in the outer districts of the city. In order to develop a unified scheme both engineering and political difficulties had to be overcome. It is now fairly certain that all the energy necessary for present and immediate future requirements of the city will shortly be obtained entirely from two large stations which have been erected on the outskirts of Paris by the Compagnie Parisienne de Distribution d'Electricité. This company was formed by a decree of the City Council in 1907, and on Jan. 1, 1914, took over the existing undertakings, paying the old companies for their generating plant and such equipment as did not revert to the municipality. The municipality obtained the mains free of charge in accordance with the terms of the old concessions. The company's concession is for twenty-seven years and expires in 1940. The company pays a royalty of $4 per km ($6.67 per mile) of street where the mains are laid. It pays rent for the old generating stations and mains, this rent being reckoned at 10 per cent on the gross receipts, depending on the amounts by which the annual gross receipts exceed those for 1908. A proportion of the surplus profits, after paying all charges, including dividends, is payable to the city on a sliding scale which is based on the amount of dividends paid.

The municipality also obtains its energy at a rebate of from 30 to 35 per cent. The consumers are protected by a tariff fixed by the terms of the concession. This specifies that the maximum price is 10 cents per kw-hr. for lighting and 6 cents for motor service plus rentals for meters and internal-service lines. This tariff is subject to revision at the end of the first three years, or at any time thereafter if the cost of production is considerably reduced by the discovery of some new process. At the expiration of the term of concession in 1940 the whole of the plant and works becomes the property of the city free of charge, while the city has power to terminate the agreement in 1924 or thereafter on certain terms. The new stations will generate two-phase currents at 12,300 volts and a frequency of forty-two, and will supply energy to a number of substations in various quarters of Paris. Of the two new generating stations, one (the Nord) has been erected at St. Ouen and the other (the Sud-Ouest) at Issy-les-Moulineaux. The total rating of these two stations is 150,000 kw, while the connected load in Paris in 1912 was 226,890 kw, the kilowatt-hours sold during that year being 76,461,411. The average price obtained was 11 cents per kw-hr. The Nord station has been designed for an ultimate rating of 150,000 kw, though at present only eight turbo-alternator groups are installed, each with a rating of from 10,000 kw to 15,000 kw. The article is to be concluded.—London *Electrician*, May 8, 1914.

Wires, Wiring and Conduits

Wiring Rules.—The conclusion of the new set of rules of the German Association of Electrical Engineers for wiring material, such as fittings, plugs, fuses, hand-lamps, etc.—*Elek. Zeit.*, May 7, 1914.

Insulators.—An illustrated article on recent advances in the principles of design of insulators.—*La Revue Elec.*, May 1, 1914.

Electrochemistry and Batteries

Electric Furnaces.—E. F. Northrup.—An illustrated article in which the author expresses the opinion that in order to obtain the highest temperatures in an electric furnace the use of a vacuum furnace is a step in the wrong direction, and that it would be better to aim at obtaining a furnace in which the pressure might be made very great and the atmosphere made absolutely inert by electrically heating comparatively large masses of graphite to a moderate temperature. One may then obtain the desired maximum temperature by a rapid input of a large amount of energy in a small and centrally located resistor unit. The object is obtained by the author by the use of a cascade adjustment to his electric graphite furnace. This device easily melts tungsten and gives a temperature, without perceptible depreciation of the graphite resistor unit used, which certainly exceeds 3000 deg. C. It is placed in and fills the chamber of the high-temperature graphite furnace. The large furnace is first brought to a temperature of approximately 1600 deg. C., and then by means of a switch the energy (obtained from the same transformer) is transferred to the heating element of the device. This heating element is a slotted tube of re-graphitized Acheson graphite. The internal chamber, which acquires a perfect black-body temperature, exceeding 3000 deg. C (or less if desired), is 15 cm. As the temperature is produced in steps falling from a maximum temperature in the inner chamber to a lower temperature in the furnace chamber (into which the device is readily fitted or removed), the author calls it a "cascade" attachment. The arrangement of the furnace is described and some results obtained with it are given.—*Met. and Chem. Eng'ing*, May, 1914.

Welding.—T. T. Heaton.—A paper read before the British Institution of Mechanical Engineers on some modern methods of welding. The author first discusses electric welding systems, namely, the Benardos arc-welding system, the Strohmenger-Slaughter system and the Thomson-Houston contact-welding system. He then takes up acetylene welding and compares it with electric welding.—London *Electrician*, May 15, 1914.

Thermo-Galvanometer.—A note on a recent (British) Physical Society paper on a new type of thermo-galvanometer. The puff of air from an orifice in an air chamber when the air within is suddenly heated is utilized in this instrument to deflect a small suspended vane. The current to be measured is made or broken through a heater of small thermal capacity in the air chamber, and the outrush or inrush of air through the orifice delivers an impulse to the vane. The disturbing effects of extraneous heat and pulsations of external pressure are eliminated by a compensation method. In one instrument of this type the sensibility was 4 mm per microwatt and the extremity of the throw of the vane was attained in two seconds.—London *Electrician*, May 1, 1914.

Telegraphy, Telephony and Signals

Submarine Cable Circuits.—An article on experiments made to obtain a greater output from the telegraph and telephone submarine cables connecting England with Ireland and Continental Europe. Disturbances in submarine telegraph cables due to stray currents, etc., have been one of the chief difficulties in connection with successful cable telegraphy. The disturbance is very much more marked when the submarine cable contains more than one circuit, because any change of current in one circuit obviously induces a current in each of the neighboring circuits, with the result that the sensitivity of the receiving apparatus has to be reduced sufficiently to avoid the effects of these induced currents. Speaking generally, this reduction in sensitivity reduces the working speed to about half of what it should be. With the view to avoiding this reduction of speed in working, experiments are being made with metallic-circuit working and superposed circuits, as indicated in Fig. 1. This represents a four-wire cable and shows how four circuits entirely free from inductance disturbance from each other can be obtained. Circuits 1 and 2 work on ordinary metallic loops; circuit 3 is superposed on circuits 1 and 2; circuit 4 is superposed on circuit 3. There are thus three loop circuits and one earthed circuit. The latter, although the equivalent of a single-wire circuit, is not subject to any inductive disturbance from the other three. It is

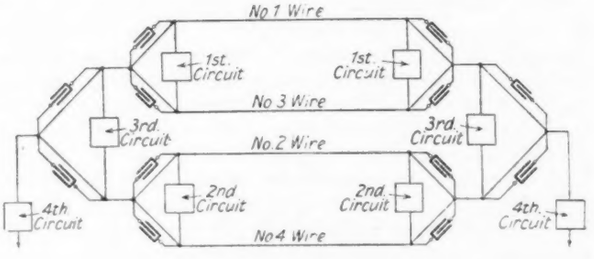


FIG. 1—WIRING DIAGRAM

well known that a loaded cable can be constructed, either on the coil or continuously loaded principle, to give three independent double-wire telephone channels in a four-wire cable. The interesting point about the experiments which are now being carried out, however, is the extension of the principle so as to obtain a fourth independent loaded circuit in such a cable. Fig. 2 shows

two ways of achieving this object. The diagram represents a four-wire coil-loaded telephone cable. Circuits *AA, BB* and *CC* are worked on the usual phantom scheme and are loaded in the regular manner. Circuit *DD* is obtained by working in parallel through all the four wires. If the phantom coil combination at each loading point consists of two separate loading coils (one

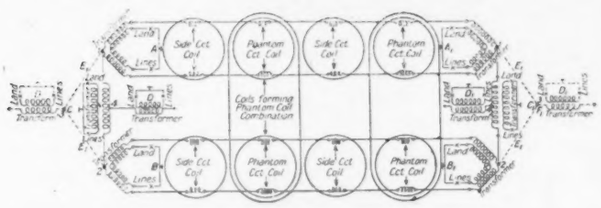


FIG. 2—WIRING DIAGRAM

coil in each pair of wires and two windings on each coil), then all the windings in circuit *DD* will be inductive as well as in *AA, BB* and *CC,* and therefore the four circuits will be loaded. The scheme also applies to a continuously loaded cable. As an alternative to tapping off the earth circuit at 4, the arrangement shown in dotted lines may be adopted for this circuit, *E* and *E* being inductive impedances in series from 1 to 2, but non-inductive in parallel from 3. If this latter method be adopted, the transformers in circuit *C* may theoretically be dispensed with, but there is an advantage in retaining them for practical reasons. Experiments on a coil-loaded cable between England and Ireland and a continuously loaded cable between England and France have given excellent results, and telephone circuits are now working on this system.—London *Electrician,* May 8, 1914.

Long-Distance Telephony.—E. F. PETRITSCH.—A report of a lecture giving a review of the problems of telephony over long distances with special reference to the loading of telephone lines and to the use of telephone relays.—*Elek. u. Masch.* (Vienna), May 10 and 17, 1914.

Wave Detectors.—P. R. COURSEY.—In the case of the oscillation valve detectors invented by Mr. J. A. Fleming, if the second differential of the characteristic or volt-ampere curve is plotted, it bears a considerable resemblance to the curve of sensitiveness of the valve to wireless signals. The tests described in this article were undertaken with a view to finding out whether any similar relation could be traced in other detectors than the valves, such as the crystal receivers so commonly employed in the wireless stations of to-day. The detectors examined in this manner were: Carborundum, electrolytis, galena, molybdenite, "Perikon" (zincite-chalcopyrite), tellurium-aluminum, zincite-bornite and others. In the majority of cases the second differential of the characteristic gives a good indication of the sensitiveness of the detector, as in the case of the oscillation valve, but some detectors, notably the galena and electrolytic, seem to show that there are other actions at work which may oppose the one depending on the curvature of the characteristic. Since this also occurs with one of the electrolytic detectors, it perhaps points out that this other action may be electrolytic in nature.—London *Electrician,* May 8, 1914.

Wireless Telegraphy.—P. BOUVIER.—A mathematical article in which the author describes a method for calculating wireless-telegraph stations in which the phenomenon of primary resonance is utilized. Practical tables permit carrying out quickly the numerical calculations. Some numerical examples are added to the article to aid in making the method clear.—*La Lumière Elec.,* April 4, 1914.

Book Reviews

WORK, WAGES AND PROFITS. By H. L. Gantt. New York: The Engineering Magazine Company. 312 pages, 27 illus. Second edition. Price, $2.

The author's experience as consulting engineer to numerous large manufacturing organizations lends this little treatise a particular interest. The book is full of intelligent comments, emphasizing the tendency to waste and improvidence, and its value lies to no small extent in an appreciation of economic conditions and facts which a theoretical author could never have possessed.

INVESTIGATING AN INDUSTRY. By William Kent. New York: John Wiley & Sons, Inc. 126 pages. Price, $1.

Mr. William Kent's book attempts to deal with a diagnosis of the diseases of management. It is prefaced by a very able introduction, written by Mr. Henry L. Gantt, which may be summed up as saying that recognition by a board of directors of the mistakes in management is usually not made until the returns have become unsatisfactory, and when this state of affairs has been attained it is radical and revolutionary steps which appeal to a board of directors, rather than the conservative elimination of weak places by a slow process. It is the old story of the two extremes to which human nature is prone. The great fault of all books which attempt to tell the manufacturer why he is unsuccessful lies in the fact that he, perhaps, is aware of the reasons, but that the human factor with which he has to deal does not often give him the opportunity to avoid his difficulties. Mr. Kent's little book is interesting as an essay on a much-talked-of subject.

WORKMEN'S COMPENSATION AND INDUSTRIAL INSURANCE UNDER MODERN CONDITIONS. By James Harrington Boyd. Indianapolis: The Bobbs-Merrill Company. Two vols., 1622 pages. Price, $9 for set.

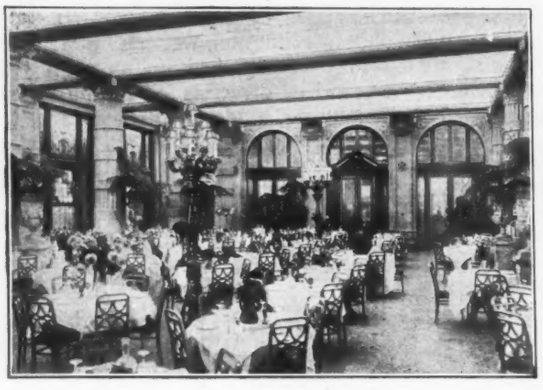
This valuable work deals judiciously with the operation of legislative measures in the different states of the Union in regard to the compensation of workmen and industrial insurance. The first five chapters deal with the distinctions between the common law, employers' liability laws, workmen's industrial insurance laws and workmen's compensation laws relating to the compensation of workmen injured in the course of their employment. A historical review of the development of workmen's industrial insurance and compensation laws is then given, followed by a description of the German plan. Compulsory industrial insurance as practised in Germany is submitted for review. The remaining chapters deal with foreign compensation laws, with the Washington workmen's insurance act, the Ohio workmen's insurance act, and the compensation acts of Wisconsin, New Jersey, California, Nevada, Kansas, New Hampshire and Massachusetts. In the second volume the compensation acts of Illinois, Michigan, Rhode Island, Arizona and Maryland and the federal compensation act are treated of. In Chapter XXV problems common to the various American statutes and statutory definitions of workmen are discussed. Chapter XXVII deals with injuries for which compensation is allowed, and later chapters deal with the amount of compensation. The concluding chapters of this volume deal with the British workmen's compensation and national insurance act of 1911 and the German workmen's insurance code of July 19, 1911. The book is a very thorough compilation and should prove of great value on the shelves of every corporation officer or lawyer.

New Apparatus and Appliances

An Illustrated Descriptive Record of Recently Developed Manufactured Products of Interest to Electrical Readers

Lighting System in Hotel Dining Room

Both direct and indirect lighting are being used in the illumination of the dining room of the Bellevue-Stratford Hotel, Philadelphia, which is called the "palm" room. Straight-filament tungsten lamps placed in the coves provide the indirect illumination. Direct light is also obtained from the candelabra shown mounted on the tall upright stands. The brilliancy of the latter lighting is toned down by means of soft-brown-silk shades. The object of combining the subdued direct illumination with the indirect, it is said, is to relieve the impression of coldness which is sometimes encountered in indirect lighting and to rest the eyes with the soft color effect obtained.



PALM ROOM, BELLEVUE-STRATFORD HOTEL

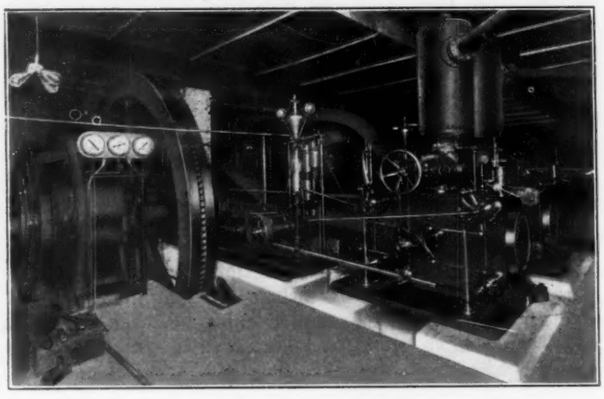
The straight-filament lamps used in the installation are known as the "J-M Linolite" and were manufactured by the I. P. Frink Company, New York. The H. W. Johns-Manville Company, New York, installed these lamps.

Corliss Engine Installation in Lytton Building, Chicago

In the plant of the Lytton Building, Chicago, the main engines are two Nordberg 19-in. by 32-in. by 42-in. cross-compound Corliss engines, driving 400-kw Crocker-Wheeler direct-current generators. These units are shown in the accompanying illustration.

The governors used on the engines are of the inverted, weighted, isochronous type. The governor is driven by pulley and belt through gears which run in oil. The safety device consists of a latch supporting the fulcrum of the counterpoise levers. When the belt idler drops, this latch is released and the dead weight pulling the fulcrum of the lever down moves the knock-off cams into position of zero cut-off. Connection from the governor to the knock-off cams is through a parallel motion.

The engines are equipped with long-stroke gear in which oscillating slotted cams, shown in the illustration, are used instead of the customary stationary cams. These cams have two concentric circular slots of different radius joined by a transition slot. When the roller of the hook is in one of the cam slots the valve is released. The whole mechanism is oscillated from the wrist plate by the customary valve arm and the cams receive a second oscillating motion from a small knock-off eccentric on the engine shaft. The point of cut-off is controlled from the governor by changing the center of oscillation of the cams, thus changing the time of the stroke when the roller passes through the transition slot. This long-stroke valve gear is designed to reimburse the flywheel with energy by taking steam for full stroke until full control is obtained by the governor.



CORLISS ENGINES IN LYTTON BUILDING, CHICAGO

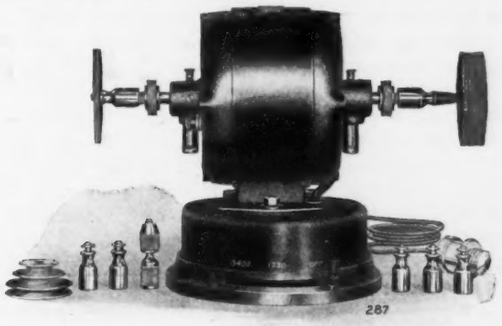
The low-pressure cylinder of the engines is fitted with long-range gear, which is oscillated by a knock-off eccentric similar to that used on the high-pressure cylinder. The connection from the governor crosses beneath the engine and changes the position of one side of the oscillating parallelogram and of the cut-off of the low-pressure valves through an adjustable range of the high-pressure cut-off. The electrical equipment of the Lytton Building was described in the *Electrical World*, July 5, 1913.

Alternating-Current Dental-Lathe Motor

An alternating-current motor designed to operate small lathes for dental and similar service is being placed on the market by the Robbins & Myers Company, Springfield, Ohio. The motor is rated at 1/6 hp and is built for operation with sixty-cycle current at 110 volts or 220 volts. A speed-changing device in the base gives speeds of 1750 r.p.m. and 3400 r.p.m. The motor will also operate on fifty-cycle circuits at speeds of 1400 r.p.m. and 2900 r.p.m. The end heads of the motor are solid and completely inclose the motor, protecting the working parts from dirt. The rotor is of the clutchless type. The starting winding is cut out automatically when the motor comes up to speed.

The following special attachments are used with each motor: 10 ft. of black reinforced cord and a plug for attaching the motor to a lamp socket; a right-hand

tapered chuck for the buffing wheel; right-hand and left-hand chucks for grinding wheels with 0.3125-in. hubs; a thirty-ply buffing wheel, 3 in. in diameter; a carborundum wheel, 3 in. in diameter, with a 0.25-in. face and a 0.3125-in. bore; a brush wheel, 3 in. in diameter, and



DENTAL-LATHE MOTOR

a three-step V-grooved pulley with pitch diameters of 1.4375 in., 1.9375 in. and 2.375 in. for a 0.3125-in. round belt. A set of Ritter chucks may also be used if desired. This set consists of three right-hand and three left-hand flange chucks for the grinding wheel with hub diameters of 0.25 in., 0.3125 in. and 0.375 in.; a left-hand taper-threaded chuck for buffing wheels, and an adjustable chuck for drills, burrs, etc.

Cable Clamps with Long Service Record

The cable clamps shown in the accompanying illustrations are part of an installation of 500 clamps made during the year 1909-10 for the Union Railway, New York. Since that time no outlays have been made for maintenance.

In Fig. 1 is shown an installation at Boston Road and Hoe Avenue which is of interest on account of the vertical arrangement of cables on poles. The cable is 500,000 circ. mil in size. The insulation is partly removed from the conductors as shown in the left of the illustration, this being brought about by the fact that

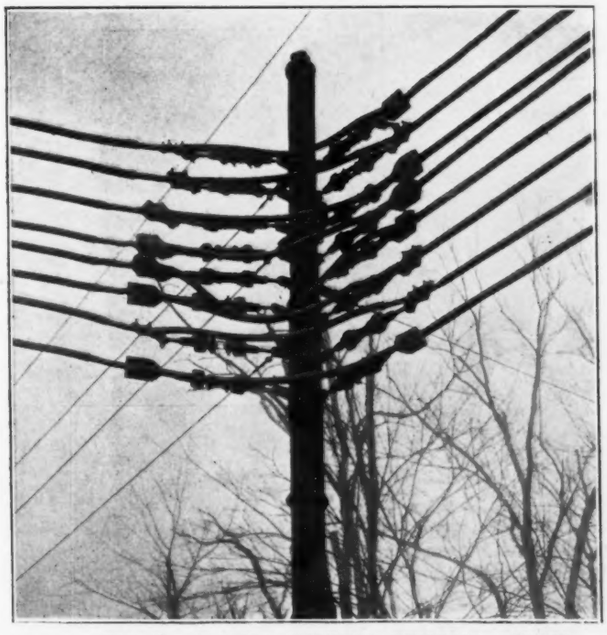


FIG. 1—CLAMPS HOLDING VERTICAL CABLES

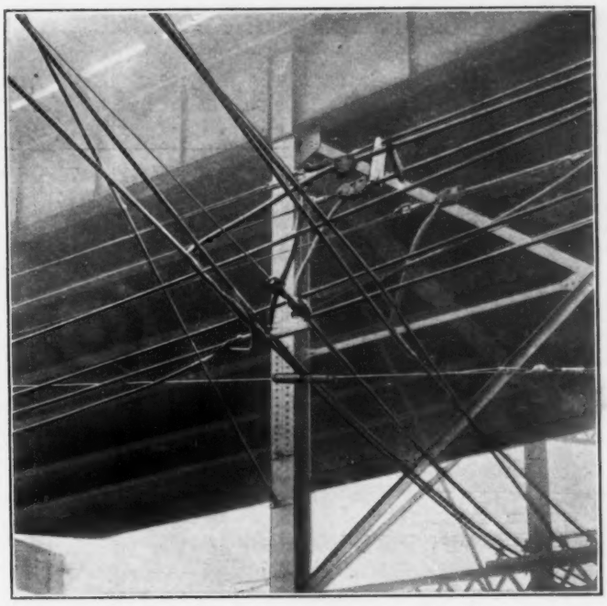


FIG. 2—CORNER TURN OF CABLE

when the pole was replaced in 1910 it was not possible to put it exactly in the same place as the original pole. No maintenance charges have been made on these clamps. The bolts and clamps have not rusted, as galvanized clamps were used.

A corner turn of 500,000-circ. mil cable made in the air by means of cable clamps is shown in Fig. 2. Owing to the length of the span, which is 170 ft., it is almost impossible to pull the cables taut enough to separate them, and it was on this account that the wooden block shown was used. This installation was considered temporary, although it has served its purpose well up to date, and the holding power of the clamps has apparently been unimpaired. The clamps used in these installations were manufactured by W. N. Matthews & Brother, St. Louis, Mo.

Portable Mine Pump

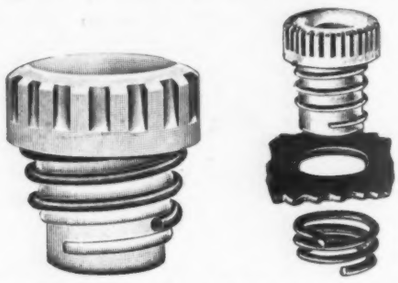
A 4-in. by 6-in. portable triplex electric pump is being placed on the market by the Goulds Manufacturing Company, Seneca Falls, N. Y. This pump is of the outside-guided type. It is so made that suction or discharge can be taken from either side. The machine has an output of 65 gal. per minute and is designed to

PORTABLE ELECTRIC MINE PUMP

pump against elevations up to 500 ft. The truck upon which this pump is mounted is constructed entirely of iron and is fitted with adjustable axles which can be used on any gage of track. All working parts of the pump are thoroughly covered by guards to protect them from grit and falling rocks and to prevent injury to the life and limbs of the workmen. No part of the pump or motor projects below the truck platform, and therefore there is no danger of any part catching in débris between the tracks.

Bushings for Outlet Boxes

The wire-insulating bushings for outlet boxes and cabinetwork shown in the illustrations are being placed on the market by the Multi Refillable Fuse Company, 723 Fulton Street, Chicago. These bushings consist of



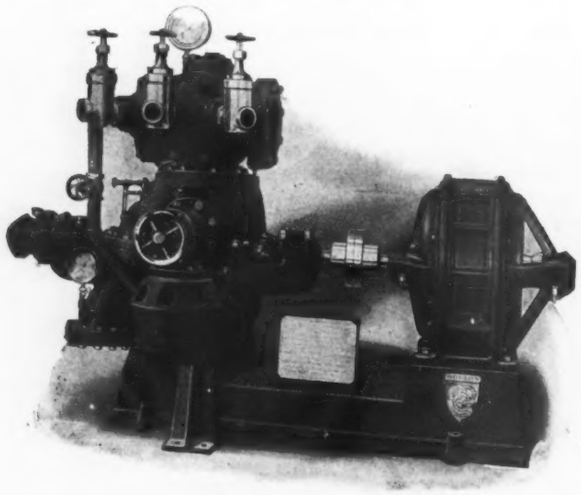
INSULATING BUSHINGS FOR OUTLET BOXES AND CABINETWORK

threaded porcelain bodies made in sizes to fit standard steel-box knockouts, and are clamped securely in place by the threading on the helical spring which engages the threads of the porcelain.

These bushings, the manufacturers claim, will not work loose under continued vibration because of the resiliency of the spring, which relieves the direct jar on the porcelain. The coil springs are tempered and oxidized, so that they will not be affected by rusting. The small prong shown on the inner side of the coil facilitates the removal of the spring when it is desired to withdraw the bushing.

Centrifugal Fire Pump

Among some of the characteristics said to be desirable in a small fire pump are large capacity for the floor space required, small weight, low first cost, simplicity of construction and operation, ability to maintain a steady pressure at the discharge, and adaptability for direct connection to electric motors or steam turbines.



TWO-STAGE CENTRIFUGAL FIRE PUMP

The two-stage centrifugal fire pump illustrated herewith has, according to the manufacturer—the Gould Manufacturing Company, of Seneca Falls, N. Y.—all these advantages. The pump has a lifting capacity of 750 gal. per minute and is designed to maintain a pressure of 100 lb. per sq. in.

The casing of this pump is made of close-grained cast iron and is uniform in thickness. It consists of two castings only, and it is horizontally divided on a plane passing through the center of the shaft. Both suction and discharge nozzles are cast integral with the lower half. The upper and lower halves of the casing are bolted together and are maintained in accurate alignment by means of taper dowel pins. By removing the upper half the impellers and shaft as well as the water passages of the pump are entirely exposed. This permits the pump to be inspected or dismantled without breaking either the discharge or suction-pipe connections. The impellers are of the inclosed type and are made of phosphor bronze. A heavy bedplate of cast iron is provided for supporting the pump and the driving unit. This bedplate is heavily beaded at the bottom and is fitted with lugs for anchor bolts. The coupling between the pump and driving unit is of the flexible type. This coupling is so designed that the pump shaft may be removed without disturbing the position or alignment of the driving unit.

Electric Vacuum Cleaner

The vacuum cleaner shown in the accompanying illustration is being placed on the market by the Sterling Machine & Stamping Company, Wellington, Ohio. In order to bring the price of this machine down to a low figure, the construction has been made simple, and instead of aluminum castings used in other machines put out by the above company steel stampings have been used wherever possible. The shoe is 12 in. long and is equipped with a revolving brush which picks up ravelings and lint. The suction is direct, there being no metal between the carpet and the fan. The fan is of aluminum cast in one piece. The switch is attached to the handle, and a quarter turn to the right starts

ELECTRIC SUCTION CLEANER

or stops the motor. The dust collector is made of a dust-proof fabric which can be laundered when soiled. This collector is attached to the machine with an air-tight connection. The shoe is fitted with four small wheels. The cleaner is only 6 in. high and weighs 8 lb.

Single-Unit Post for Incandescent Lamp

The ornamental lamp-post illustrated herewith is for use with nitrogen-filled tungsten lamps. The lamp is inclosed in a large outer globe. Air passes through ventilation holes in the globe holder, then goes upward around the lamp socket and lamp and out through holes in the top ventilator. These holes are protected with perforated metal which keeps the insects out. The ventilator is so designed that most of the light rays in the vertical direction are reflected downward, only enough being thrown above the lamp to light the façades of buildings. Most of the light is thrown below the lamp, where it is required in lighting the sidewalks and streets. Either 750-watt or 1000-watt multiple lamps or any of the types of series street lamps may be used.

The base of the post is 16 in. in diameter and 17 in. high. The height of the post to the bottom of the 16-in. globe is 10 ft., and to the top of the ventilator 11 ft. 10 in. This post is of cast iron. The ornamental post and the ventilator described are being manufactured by the George Cutter Company, South Bend, Ind.

Electric Dishwasher

In the electric dishwasher illustrated herewith dishes, glasses and silverware are cleansed by water played upon them under pressure from a center cylinder and circulated by means of a motor-driven centrifugal pump. The dishes do not move, and as the pressure of approximately 6 lb. per square inch maintained is insufficient to shift the dishes in the racks made to hold them, all danger of breaking, the manufacturers claim, is eliminated. Only six quarts of hot water are required for washing one lot of dishes. This water is circulated over the dishes at the rate of 30 gal. per minute.

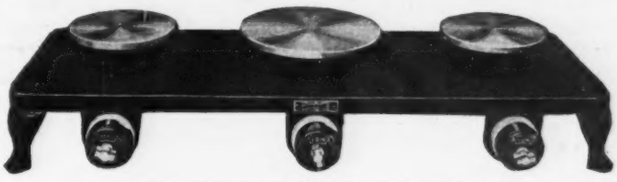
The machine consists of a nickel-plated copper tank

ELECTRIC DISHWASHER

in which racks containing the dishes are set and beneath which on a platform supported by legs are placed a directly coupled centrifugal pump and a 0.25-hp motor. The pump operates at 3600 r.p.m. The pump discharges the water into a cylinder which threads into a flange on the pump. This cylinder is 18 in. high and has many holes which are staggered and through which the water is distributed to all parts of the tank. The intake for the pump is directly alongside the cylinder, and the water draining from the dishes returns to the pump through a screen which is held in place by the pump suction and which removes all food particles before the water is again returned to the dishes. The machine is designed so that the water may be introduced from the top by means of a water receptacle or hose, but it is most efficient when directly connected to a hot water main and a drain. When no permanent connection is desired this washer is equipped with casters. The weight of the apparatus complete is approximately 100 lb.; its over-all height is 34 in. and its diameter 24 in. This machine is being made by the Electric Dishwasher Company, 40 Pearl Street, Buffalo, N. Y.

Electric Disk Heater

The disk heater shown herewith is made in two-stove and three-stove combinations, using 6-in., 7-in. or 8-in. disks. It is equipped with a lock-on device by means of which the utensils are locked to the stove, thus insuring perfect contact and obviating waste of heat between the stove and the utensil. The construction is rugged, and the method of mounting the disks on the frame is designed to prevent the waste of heat by conduction. All the heat, therefore, goes into the cooking, the frame remaining cool. All parts are easily accessible for



THREE-STOVE ELECTRIC DISK HEATER

cleaning. The wires and connections are protected from accidental interference by a special type of stove mounting. Each stove is regulated by a three-heat snap switch. This device is being placed on the market by the Simplex Electric Heating Company, Cambridge, Mass.

Portable Loading Device

A portable loading device for meter testing, consisting essentially of a constant-potential transformer with low-voltage secondary and resistors connected in the secondary circuit, is being manufactured by the States Company, Hartford, Conn. The transformer is built for connection to any circuit of ordinary voltage, the primary being wound in sections for multiple or series connection so that the same load may be used on circuits of different voltages. The transformer being of the constant-potential type and having no resistance in series with the primary, the core magnetization is constant at all loads and abnormal wave-forms are thus avoided. The control is by means of the resistors connected to the secondary of the transformer. The resistance is of a value determined by the current desired, and each resistor is connected in circuit by means of a single-pole knife switch. When in use the resistors are in multiple so that the current may be adjusted to its desired value by using the switches selectively.

The value of the current at any time may be found by taking the sum of the numbers marked on the switches closed. This amount will vary slightly owing

to potential drop in the leads, contacts and instrument windings, but with reasonable care in making connections it may be relied upon as sufficiently approximate for the purpose of testing watt-hour meters when a rotating standard is employed. When an indicating wattmeter is used as a standard the load can be closely

PORTABLE LOADING DEVICE FOR METER TESTING

adjusted. The load steps are by 0.25-amp increments from 0.25 amp to the full rated output of the transformer.

The secondary current when testing all forms of commercial watt-hour meters is substantially in time-phase with the emf impressed on the shunt windings of the instruments, the conditions being equivalent to those obtained with an actual load with a power-factor greater than 97 per cent. Many watt-hour meters are used in connection with series and shunt instrument transformers for measuring energy at high voltages. With the 5-amp apparatus shown herewith, these meters, the manufacturers claim, can be tested in service position by connecting the load to the shunt transformer and testing as a 5-amp meter, provided the shunt transformer has a rating of 50 watts or more.

Pump for Inflating Automobile Tires

The equipment illustrated herewith is used for inflating automobile tires. It consists of a two-cylinder pump and a small electric motor which are mounted on

MOTOR-DRIVEN PUMP FOR INFLATING AUTOMOBILE TIRES

a frame. Twenty feet of reinforced-rubber air hose with pressure gage attached and 20 ft. of lamp cord with plug are furnished with this apparatus. No tank is required. The operation is simple, consisting of attaching the end of the hose to the tire valve, turning on the switch and then turning it off again when the gage shows that the desired pressure has been obtained. It is claimed by the manufacturers that this master garage pump, as it is called, will completely inflate a 37-in. by 5-in. tire to 90-lb. pressure in less than three minutes. No rubber packing rings are used and the delivery of pure air entirely free from oil is said to be insured.

This pump is being made by the Hartford Machine Screw Company, Hartford, Conn. It is operated by a General Electric motor.

Brass-Shell Sockets

Brass-shell sockets equipped with automatic locking rings are being made by the Cutler-Hammer Manufacturing Company, Milwaukee, Wis. These sockets are rated at 660 watts for 250-volt circuits. The automatic locking ring is designed to replace the iron set screw hitherto used for securing the socket to the fixture. This locking ring, the manufacturers claim, makes it

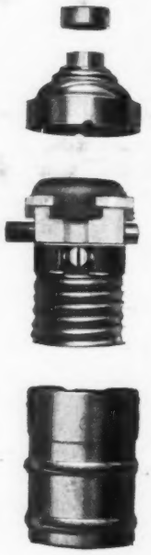


FIG. 1 — EXPLODED VIEW OF PUSH-BUTTON BRASS-SHELL SOCKET

FIG. 2 — KEYLESS ELECTROLIER SOCKET

FIG. 3—PUSH-BUTTON BRASS-SHELL SOCKET

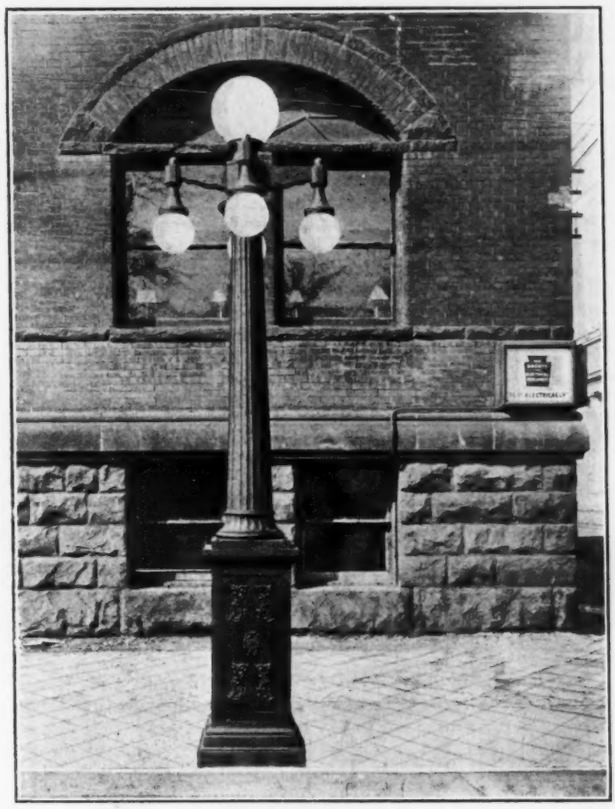
possible to attach the sockets securely on fixture nozzles even when socket covers or husks are used. The cap is made of heavy brass. The fiber insulation for the cap is attached to the porcelain body. Two locking nibs are provided on the cap and they engage with slots in the brass shell. These nibs extend inward; the possibility, therefore, of mutilating and destroying these nibs when buffing the cap is said to be small. A cord grip is provided for use with the pendent sockets. This cord grip does not require any threading through or twisting of the conductors. The conductor terminals are secured to the binding screws, which are placed far down on the socket and are upset so that they cannot be lost. Push-button operation is used with the pendent sockets.

These brass-shell sockets have been approved by the National Board of Fire Underwriters.

Jobber, Dealer and Contractor

Sign Showing Emblem of Electrical Development Society

The accompanying illustration shows how the Electrical Construction & Machinery Company, of Rock Island, Ill., has made use of the emblem of the Society for Electrical Development to advantage. The sign is



HOW AN ILLINOIS COMPANY MAKES USE OF THE EMBLEM OF THE ELECTRICAL DEVELOPMENT SOCIETY

24 in. by 30 in. and is made of copper. It faces both streets and back of it are four 25-watt lamps which burn from dusk until 10.30 each night. The society is naturally anxious that its members shall make the widest use of the emblem, and certainly the Electrical Construction & Machinery Company, of Rock Island, has set an excellent example.

Contractors Co-operate in Electric Show at Tulsa, Okla.

The Public Service Company of Oklahoma, in conjunction with four representative contractors and dealers of Tulsa, recently conducted the first electric show ever attempted in the State. The dealers and contractors co-operating were the Deshon-Davidson Company, the Dodge Electric Company, the Tulsa Electric & Construction Company and the Electric Supply Company.

Using the grill room of the Hotel Tulsa as the scene of the display, booths were fitted up for each dealer, two being occupied by the exhibits of the central-station company. Very little newspaper or other advertising was done, but announcements and printed invitations were sent to all present and prospective residential lighting customers of the Public Service Company in Tulsa. Ten thousand persons accepted these invitations, and most of them stayed long enough to enjoy the electrically cooked dainties served by eight young ladies, members of the department of domestic science in the Tulsa High School.

Of the two booths occupied by the central-station company, one represented a modern kitchen equipped with an electric fireless cooker, electric lamps and baseboard receptacles for fans and irons. The other booth was labeled "The Old Way," and the antiquated methods of kitchen work were typified by an old wood stove, kerosene lamps and palm-leaf fans.

Mr. J. L. Ferry, new-business manager of the Tulsa company, reports that the show was a huge success in every sense. Many sales were made outright and numerous others resulted in the week following the close of the exhibition.

Co-operation Between Indianapolis Supply Men and Central Station

An arrangement by which the Merchants' Heat & Light Company of Indianapolis becomes the sponsor for practically all of the larger electrical appliance houses in that city has just been made public with the establishment of a showroom for all types of electrical household supplies in the downtown offices of the Merchants' company on South Meridian Street. To six of the larger electrical supply houses in the city show space has been given in the office of the Merchants' company, through which all consumers supplied by that company are required to pass to pay their bills or to make new contracts. Practical demonstrations of the use of each appliance are being given daily, and the exhibit is to be continued indefinitely.

Already unusually large sales records have been built up by the companies through this arrangement. Electric sweepers, washing machines, stoves, heaters, hotplates, fans, percolators, toasters, ovens, chafing dishes and many other types of electrical devices are on exhibition, and there is a constant display of warm fudges, biscuits, rolls, bread, cake and many other delicacies, cooked on electrical devices, to tempt the customer of the electric company.

Each of the six companies has the outside display windows of the electrical company for a week, in rotation, and the most attractive features of their inside display are placed in this window.

Officials of the Merchants' company, in explaining their purpose in thus stimulating the trade in these electrical appliances, said they had held many conferences with local supply houses and the net result of these conferences had been that a campaign of "electrically educating" the people of the city had been undertaken. Education as to the low costs and high values of the electric fan in the home, for instance, is to be one feature of the campaign, the management of the electric company said; and, of course, every new appliance purchased brings new consumption onto the books of the electric company. The officials of that company say they will continue their co-operation with the electrical supply houses indefinitely.

The local houses, some representing foreign companies, which already have joined with the electrical company in the novel co-operative scheme follow: Varney Electric Supply Company, Western Electric Company, Sanborn Electric Company, Indianapolis Electric Supply Company, F. H. Cheyne Electric Company and Hatfield Electric Company.

Industrial and Financial News

Public Utility, Commercial, Corporate and Trade Developments—The Electrical Material and Security Markets

Electric Plant Damaged Slightly by Fire.—The plant of the Apple Electric Company, Dayton, Ohio, was damaged slightly by fire recently. The operation of the plant was not interfered with to any great extent, and shipments have been made regularly since the fire occurred.

Reservations for Pittsburgh Chamber of Commerce Trade Tour.—Among the firms having engaged reservations for the Pittsburgh Chamber of Commerce annual trade tour are the Doubleday-Hill Electric Company, the Westinghouse Electric & Manufacturing Company and the Western Union Telegraph Company.

Orders for Gas-Electric Motor Cars.—The General Electric Company received an order recently for several gas-electric motor cars from a large Western railroad system. These cars are said to be used considerably in the West on branch lines where traffic is light. The demand for this type of transportation in the East has never been very great.

Motor Manufacturers Busy.—The Bell Electric Motor Company, Garwood, N. J., is reported to be receiving a number of orders from central stations and contractors for its compensated type of polyphase motor, described in the *Electrical World* Dec. 20, 1913. Business in the vicinity of New York City for this company is said to be particularly good.

Electric Terms for the Baseball "Fan."—Pass & Seymour, Inc., have got out three neat cards containing the playing schedules of the three major baseball leagues, together with scoring diagrams. Printed on these cards besides the pure advertising matter are such captions as "A service sure to make a strike," "Make a hit with your trade," and "Talk the 'shurlock' and steal a base on your competitor."

Motors for Paper Mills.—Orders for motors to be used in operating paper-mill equipment have been placed with the Westinghouse Electric & Manufacturing Company by the following companies: S. D. Warren & Company, West Brook, Maine, five 150-hp, 315-r.p.m. motors for driving a Jones-Jordan machine and J. E. Henry & Sons, Lincoln, N. H., one 125-hp, 375-r.p.m. motor for driving a Jones-Jordan machine.

Stationary Vacuum Cleaning Apparatus.—The Thurman Vacuum Cleaner Company, St. Louis, Mo., is placing on the market a stationary vacuum cleaner which is sold for $150, and which is cheaper than similar types of machines previously put out by the above company. This machine is particularly well adapted for hotels and office buildings. The number of sales recently of this and other types of cleaners, it is reported, is quite large.

Standardization Rules of the Electric Power Club.—The second edition of a booklet containing the standardization rules of the Electric Power Club has been issued recently. The list of members given contains nearly all the large motor manufacturers of the United States. As these rules are the result of good engineering thought, they are said to be unanimously accepted by the members of the club and by other manufacturers as well.

Solenoid Switches for Hotel Service.—Solenoid switches manufactured by the Hart Manufacturing Company, Hartford, Conn., for the automatic control of lamps in hotel guest rooms are being installed in the Morrison Hotel, Chicago, and in the new Statler and Fuller Hotels, Detroit. L. K. Comstock & Company are the electrical contractors for these three hotels. A number of orders have also been received lately by the Hart Manufacturing Company for its remote-control switches.

Manufacturer of Flash-Lamps Doing Well.—The Beacon Miniature Electric Company, 108 Duane Street, New York, manufacturer of small flash-lamps and flash-lamp accessories, is doing a good business and, although only established since Oct. 1, 1913, its space for manufacturing purposes is being doubled. This company has recently placed on the market a new flash-lamp with an improved contact device. The "Aladdin" batteries used with these flash-lamps are made by the above company.

Westinghouse Company Gets Series-Tungsten Lamp Contract.—Although all companies bidding submitted identical prices on the series high-efficiency tungsten lamps to be supplied to the Sanitary District of Chicago, the contract was awarded to the Westinghouse Lamp Company as the lowest bidder on the compensators and globes also included in the order. The prices on the lamps ranged from $4.50 each for the first 2000 to $3.655 each if the order amounted to 10,000 units. Under a similar schedule, the price of the compensators and globes ranged from $13.60 to $13.45.

Turbine Contract Awarded to General Electric Company.—On May 27 the Sanitary District of Chicago awarded the contract for a 4000-kw, 2300-volt steam-turbine and generator unit with a Worthington condenser and motor-driven accessories to the General Electric Company. Four bids were placed by the General Electric Company on this apparatus, each bid carrying a different type of condenser. The purchase price of the apparatus is $53,724. The total cooling surface of the condenser specified is 7000 ft. and the speed of the unit is 3600 r.p.m. Transformers rated at 1667 kva are to be used with this apparatus.

Motion-Picture Machine for Entertainment and Educational Purposes.—A motion-picture machine designed particularly for amateurs which adapts itself very well for use in homes or schools or factories is being placed on the market by Pathé Frères, Paris, France. Mr. Willard B. Cook, manager of the American distributing department, with offices in the Æolian Hall, New York, states that more than 10,000 machines have been sold in Europe, and since its introduction in America last fall some 200 have been sold here. The machine has been approved by the National Board of Fire Underwriters. A special non-inflammable film is used. Three models of these so-called "pathéscopes" are being made; one is hand-driven and the other two are designed for use with alternating current and direct current.

Storage-Battery Company's Business Good.—The business of the Willard Storage Battery Company, Cleveland, Ohio, it is reported, has been quadrupled in the past four years. Mr. F. S. Gassaway, district manager in New York, states that this increase is due in good part to the continual efforts of the company to give reliable service. Service stations are maintained in all the important cities of the United States and in many foreign cities. Considerable attention is given to the education of its customers regarding the proper usage of storage batteries. Booklets are printed in English, German, French and Spanish with full directions for taking care of the batteries. The Willard storage battery is used on a number of different types of gasoline automobiles as a part of the electric starting equipment, and more than 80 per cent of the American makes are said to use this battery. It is being used to a considerable extent also for the lighting of railroad cars and the propulsion of electric vehicles. In regard to the battery equipment of most electric vehicles, Mr. Gassaway declares that the batteries are not made heavy enough. The conditions with a light battery and a heavy truck, he states, are the same as those with a lean horse and a heavy truck—they are both overworked and cannot give proper and reliable service.

Exhibits at District Heating Convention.—During the Rochester convention of the National District Heating Association on May 26-28 several manufacturers made exhibits. Following is the list: American District Steam Company, North Tonawanda, N. Y., steam specialties, models of underground construction, condensation meter, souvenir pocket match holder, etc.; V. D. Anderson Company, Cleveland, models of steam traps, separator, etc.; Armstrong-Cook Company, Pittsburgh; Bigelow Company, New Haven, model of Bigelow-Hornsby water-tube boiler; Central Station Steam Company, Detroit, models of condensation meter, expansion joints, etc.; H. and M. Division of Taylor Instrument Companies, Rochester; Jenkins Brothers, New York, valves; H. W. Johns-Manville Company, New York, pipe coverings and heat insulation; Michigan Pipe Company, Bay City, Mich.; National Air Cell Covering Company, New York; Warren Webster & Company, Camden, N. J., specimens of valves, traps, etc.; A. Wyckoff & Son Company, Elmira, N. Y.

Growth of New England Central-Station Business.—Reference has already been made to the present rate of expansion of the central-station industry in the Atlantic States and Central States as indicated by official returns for March of this year. Returns from New England are now available for companies supplying electric service to the cities of Boston, Worcester, Springfield, Lynn, Cambridge, New Bedford, Providence and Hartford, and which between them are responsible for at least 35 per cent of all the energy produced in the six New England States (Maine, New Hampshire, Vermont, Massachusetts, Rhode Island and Connecticut). The total income from the sale of energy for these companies was $1,093,502 for March, 1914, against $1,020,996 for March, 1913, an increase of 7.1 per cent, while the total energy output of these companies grew in the same period from 30,192,934 kw-hr. to 32,516,426 kw-hr., an increase of 7.7 per cent. It is hardly safe to regard these figures as characteristic of the present rate of central-station expansion in New England, since official returns for February for identically the same companies showed a materially higher rate of expansion, as indicated in Table I. A word of explanation should be given of the

TABLE I—MONTHLY GROSS INCOME AND ENERGY OUTPUT OF EIGHT LARGE NEW ENGLAND COMPANIES

	Gross Income from Sale of Energy			Total Energy Output in Kw-hr.		
	1914	1913	Per Cent Increase	1914	1913	Per Cent Increase
February	$1,197,778	$1,079,490	11.0	30,095,631	27,217,230	10.6
March	1,093,502	1,020,796	7.1	32,516,426	30,192,934	7.7

fact that March shows an increase in output accompanied by a falling-off in income. The discrepancy is simply a matter of the method of central-station metering and accounting. March has three more days than February. For this reason, although during March the daily average of station output steadily decreases, yet the aggregate output of kilowatt-hours shows a marked increase over February. Published figures for income, on the other hand, hardly ever relate strictly to any calendar period, but are based upon a total of all the meter readings taken during an arbitrarily selected period which does not correspond accurately to the calendar month. Actually the daily average sales of energy usually decrease more or less uniformly during the spring months, and the average daily output probably decreases in about the same ratio. Taking the month of February, however, the output reported is usually for a period of twenty-eight days, while the income reported is usually for thirty days and takes in a part of January as well as February. This makes the official February income disproportionately high as compared with the output, although the discrepancy automatically adjusts itself to some extent in March; and the result for the latter month is a reported income disproportionately low as compared with the output. For the month of April it may be expected that the New England companies will report a decrease in both income and output as compared with the March figures; and it may be expected that the rate of increase for 1914 over 1913 will be nearer the February figures of 11 and 10.6 per cent. Meanwhile, from the 1912 census figures it is possible to compute fairly closely the total income and output of all the central stations in New England for March, 1913, and accepting the *Electrical World* expansion constants as correct, it may be estimated that the gross income of all the companies in that territory grew from $2,720,000 in March, 1913, to $2,910,000 in March, 1914, and the energy output from 86,000,000 kw-hr. to 92,600,000 kw-hr. These totals may be compared with those previously given for the Atlantic and the Central States. Assuming that for the entire central-station industry of the United States the March, 1913, gross income was $28,750,000 and the output 1,142,000,000 kw-hr., it will be seen that the remaining sections of the country—the Pacific Coast States and the Mountain States—are responsible for only some 12.5 per cent (income) and 25 per cent (output) of the total business. In those sections of the country a kilowatt-hour of electrical energy seems to have only one-half the earning power which it is known to hold in the East. To summarize all the March data which have now been received by the *Electrical World*, it may be noted that complete returns for both energy output and gross income have been rendered by companies or groups of companies operating in widely scattered sections of the country which furnish service to eighty-two of the first hundred cities, one of which shows revenue for March from the sale of energy in excess of $2,000,000, one other in excess of $1,000,000, and five others in excess of $500,000. These companies show sales for March, 1914, of $16,891,235 against $15,559,191 for March, 1913, an increase of $1,332,044, or 8.7 per cent; while the energy output of all the generating stations subsidiary to these companies was 730,843,220 kw-hr. for March, 1914, against 642,291,906 kw-hr., or 13.8 per cent. It may safely be stated that March, 1914, showed an increase in energy sales over March, 1913, of at least $2,500,000 for the entire central-station industry. For March the demonstrated increase is $2,500,000, and the required new capital must be at the very least $12,000,000.

TABLE II—INCOME AND OUTPUT FOR ATLANTIC, CENTRAL AND NEW ENGLAND STATES (ESTIMATED)

	Gross Income			Energy Output, Kw-hr.		
	March, 1914	March, 1913	Per Cent Increase	March, 1914	March, 1913	Per Cent Increase
Middle Atlantic	$10,300,000	$9,717,000	6.1	314,500,000	292,500,000	7.5
South Atlantic	1,798,000	1,615,000	11.3	104,500,000	85,170,000	22.8
Central	12,374,000	11,133,430	11.2	441,700,000	391,585,000	12.8
New England	2,910,000	2,720,000	7.1	92,600,000	86,000,000	7.7
Total	$27,382,000	$25,185,430	8.8	953,300,000	855,255,000	11.5

NEW YORK METAL MARKET PRICES

	May 26 Bid	May 26 Asked	June 2 Bid	June 2 Asked
Copper				
Standard spot*	13.70	14.12½	13.50	14.00
	Selling Prices		Selling Prices	
	£ s d		£ s d	
London, standard spot*	63 3 9		62 6 3	
Prime Lake	14.25	to 14.50	14.12½	to 14.37½
Electrolytic	14.10	to 14.20	13.95	to 14.05
Casting	13.90	to 14.00	13.80	to 13.90
Copper wire base	15.25	to	15.25	to .....
Lead	3.90		3.90	
Nickel	40.00	to 45.00	40.00	to 45.00
Sheet zinc, f.o.b. smelter	7.00		7.00	
Spelter, spot	5.10	to 5.20	5.10	to 5.20
Tin, spot	33.15	to 33.35	30.25	to 30.65
Aluminum:				
Prompt delivery	17.75	to 18.00	17.75	to 18.00
Future	17.75	to 18.00	17.75	to 18.00
*OLD METALS				
Heavy copper and wire	12.62½	12.87½	12.62½	12.87½
Brass, heavy	8.50	8.62½	8.50	8.62½
Brass, light	7.37½	7.50	7.37½	7.50
Lead, heavy	.....	3.90	.....	3.90
Zinc, scrap	4.00	4.15	4.00	4.15

*COPPER EXPORTS

Total tons to June 2 2,140

*From daily transactions on the New York Metal Exchange.

Corporate and Financial

California Power Company to Increase Stock.—A special meeting of stockholders of the Northern California Power Company has been called for July 17 to authorize an increase in the capital stock. It is proposed to issue $2,000,000 of 6 per cent preferred stock, of which $500,000 is to be issued and sold at once. Subject to approval by the Railroad Commission of California, the stock will be offered to shareholders at 80.

Michigan Northern Power Company Bonds.—Yard, Otis & Taylor and the People's Trust and Savings Bank, of Chicago, are offering at 95 and interest first mortgage 5 per cent gold bonds of the Michigan Northern Power Company. The bonds are dated July 1, 1913, and are due July 1, 1941. Of the $4,500,000 authorized, $2,000,000 are outstanding. The bonds are guaranteed, principal and interest, by indorsement by the Union Carbide Company and are a first lien on 1200 acres of land and a modern hydroelectric development on St. Mary's River at Sault Ste. Marie, Mich. The replacement value of the development has been placed at over $6,000,000. The power plant contains forty-two waterwheel units, each designed to have a capacity of 500 hp.

Dallas Electric Company Notes.—Stone & Webster and the Old Colony Trust Company, of Boston, have offered for sale at 96¾ and interest $1,500,000 Dallas Electric Company three-year 5 per cent notes dated June 1, 1914. The notes are callable at par and interest on thirty days' notice. The proceeds will be used to retire floating debt and for extensions to carhouses, shops, tracks, cars, power station and distributing systems. During the year ended March 31, 1913, 34.4 per cent more people were served by the railway and 43.6 per cent more by the light department than for the year ended Dec. 31, 1905. During the same period the gross earnings increased 141 per cent and the net earnings 155 per cent. The ratio of total capitalization to gross income decreased from 8.9 to 1.2 to 1 in the 1905 year to 5.7 to 1 in the year ended March 31, 1913.

Interstate Electric Corporation Holdings.—A. E. Fitkin & Company, New York City, have issued a booklet describing the properties of the Interstate Electric Corporation. The properties of the corporation consist of gas and electric light plants and water-works situated in communities in Pennsylvania, Kansas, Missouri and Texas and serving a population of about 50,000. The corporation was formed under the laws of Virginia. Roosevelt & Thompson, engineers, are associated with the corporation in connection with the operation of the various plants and have the supervision of all improvements and extensions. Recently the corporation has added the Great Bend Water & Electric Company, Great Bend, Kan., and the Hoisington Electric & Ice Company, Hoisington, Kan., to the plants already controlled at San Angelo and Laredo, Tex., Trenton, Mo., and Corry, Pa. In the near future the corporation intends to purchase other plants, having, finally, a large transmission system. The subsidiary Corry City Electric Light Company was organized in 1903. It has a five-year lighting contract with the city dated in 1913. So far no attempt has been made to serve industries, but on completion of the new steam-turbine electric station a start will be made in this direction. The Trenton Gas & Electric Company has two contracts with the city, one for arc and incandescent street lighting and one for white-way lighting. The gross electric light revenue per capita was $5.83. The San Angelo Water, Light & Power Company has city contracts for street lighting and for water.

Portland Railway, Light & Power Company Operations.—Gross earnings of the Portland (Ore.) Railway, Light & Power Company for the year ended Dec. 31, 1913, were $6,723,742, an increase of 1.2 per cent over 1912. Operating expenses, including taxes, were $3,298,310, a decrease of 0.9 per cent. Net earnings were $3,425,432, a gain of 3.4 per cent. Interest charges amounted to $2,008,601, an increase of 14.1 per cent. The surplus was $1,416,831, a decrease of $135,575. Franklin T. Griffith, the president, says in the annual report that the small increase in gross earnings is due principally to the business depression in the Pacific Northwest and throughout the country generally, although it is somewhat affected by the fact that comparison is made with a year during which revenues were received from the Salem Railway and the Willamette Falls Railway, both of which were sold in 1912, and by the further fact that poor weather conditions in June during the "rose carnival" resulted in decreased earnings from that source. Taxes continue very high. There was a heavy increase in fixed charges, due to the completion of the Mount Hood hydroelectric plant and the transfer of the interest charge on this investment from the construction accounts to the operating accounts. On account of the decrease in surplus the dividend on the capital stock, which had been paid at the rate of $5 per share per annum from December, 1912, was reduced to the rate of $4 per share per annum on Dec. 1, 1913. In October the company was awarded a three-year contract for all the city lighting in Portland. The importance of this contract is shown by the fact that 327 arc lamps were added to the lines during 1913, while it is estimated that the increase during 1914 will be almost as great That the electric business of the company has been widely developed is shown by the fact that on Dec. 31, 1913, the company served 42,063 lighting and motor-service customers, compared with 38,415 in 1912, and 12,294 in 1907. This is believed to be the largest number, in proportion to population, served by any company operating in a large city in the United States. In addition, the city of Portland has, with two exceptions, more consumers of electricity per capita of population than any other large city. The application of scientific management was continued, covering the operation of the lighting and motor-service department and its many divisions, the railway shops and maintenance-of-way department. Mr. Griffith says that it has been stated by those competent to judge that the company has gone further with the introduction of efficiency principles than any other public utility corporation in the country, and the results have been so satisfactory that the work is being extended to include practically all of the departments. C. M. Clark, chairman of the executive committee, makes the following statement on business conditions: "While the financial results of operation for the year have not been entirely satisfactory, they are probably as favorable as could be expected under the circumstances. It is particularly unfortunate that the depression in Portland should have come at a time when the company was prepared to handle even more than the normal growth of business. From 1905 to 1911 the growth of Portland was rapid and it was difficult to keep up with the requirements for increased facilities in the street-railway business and increased capacity in the lighting and motor-service business. Your company necessarily prepared for a continuance of this growth and, owing to the fact that during the past two years this rapid growth has not continued, the company is temporarily in a position of having greater equipment than necessary to handle its business, resulting in a large increase in interest charges without a compensating increase in revenue. The city of Portland has also been overdeveloped and large amounts of money have been expended in anticipation of the continued rapid growth in the population, with the inevitable result of heavy increases in taxation. The taxes assessed against your company have increased with all others and have helped to make up the total increase in fixed charges. The capital expenditures required during this year will be small. The development of Alaska and the opening of the Panama Canal should prove helpful in restoring to Portland the prosperity which characterized its growth in the decade preceding 1912. In addition, there are a number of local reasons for increased earnings, such as the development of the lighting and motor-service business in the Willamette Valley, including the sale of power to the Willamette Valley Southern Railway Company and the Southern Pacific Company. The overdevelopment of the territory and of your company is temporary only and may soon be changed into a condition where the capacity of the company will be fully required to meet the demands of a new period of growth and development. Even during the past two years there has been a steady growth and improvement in Oregon and in Portland, and the agricultural, financial and industrial conditions are sound and stable. The management of your company is competent, efficient and as economical as is consistent with good service. The physical condition of the property is excellent, and in all respects the management is fully prepared to fulfill its obligations."

Business Notes

The H. W. Johns-Manville Company announces that its Duluth office has been moved to larger quarters at 327 West First Street.

The Kennedy Manufacturing Company, of Chicago, is the new name of the company formerly called the Kennedy-Vanderhoof Company.

The Western Wood Preserving Company, of Los Angeles, Cal., announces the removal of its office and factory to larger quarters at 2108 East Seventh Street. R. J. Bird is president of the company.

M. B. Wheeler, for several years general manager of the Tel-Electric Company, Houston, Tex., has resigned that position and opened an office as manufacturers' agent at 1015 Union National Bank Building, Houston.

The Electrical Storage Battery Company announces that Nelson B. Hazeltine, formerly sales manager for the Adams-Bagnall Electric Company in Philadelphia, has joined its sales organization, making his headquarters at 100 Broadway, New York.

The Davidson-Lewis Metal Products Company, Inc., of 101 Park Avenue, New York, was organized recently by George Davidson, formerly with the U. T. Hungerford Brass & Copper Company, New York, and Robert P. Lewis, formerly of the Blake & Johnson Company, Waterbury, Conn.

The Phoenix Electric Lamp Company, Inc., of Brooklyn, N. Y., has absorbed the United Electric Lamp Company. The office of the latter company at 253 Thirty-sixth Street has been retained. J. H. Rees, former manager of the United Electric Lamp Company, has been made general manager of the Phoenix Electric Company, Inc.

New Industrial Companies

The Peerless Electric Vacuum Cleaner Company, of Cleveland, Ohio, has been incorporated with a capital stock of $10,000 by H. Bohn, William H. Klee, S. J. Deustch, A. E. Klein and I. J. Rothschild.

The Sevison Electric Company, of Elkhart, Ind., has been chartered with a capital stock of $10,000 to manufacture and deal in electrical equipment. The directors are M. E. Crow, J. B. Fitch and L. J. Sevison.

Henderson & Shaw, of Boston, Mass., have filed articles of incorporation with a capital stock of $10,000 to do an electrical contracting business. The incorporators are Albion W. Shaw, James A. Henderson and Guy L. Weymouth.

The United Light Company, of Cincinnati, Ohio, has been chartered with a capital stock of $5,000 to deal in gas and electrical supplies. The incorporators are Williard H. Odell, William R. Divers, Albert D. Alcorn, Grace and Frank Cooper.

The Klingelsmith Electric Truck Company, of Portland, Maine, has been incorporated with a capital stock of $500,000 to manufacture and deal in motor trucks, etc. A. F. Jones is president and A. A. Richards, treasurer, both of Portland, Maine.

The Kingsland-Tess Electric Fly Catcher Company has filed articles of incorporation under the laws of the State of Delaware. The company is capitalized at $50,000 and proposes to manufacture fly-catching apparatus. The incorporators are W. Boyd, W. I. N. Lofland and W. F. P. Lofland, of Dover, Del.

The Producer Gas-Electric Corporation has filed articles of incorporation under the laws of the State of Delaware. The company is capitalized at $500,000 and proposes to manufacture gas engines, machinery, etc. The incorporators are J. F. Curtin, H. F. Kleist, of New York, N. Y., and J. M. Satterfield, of Dover, Del.

The Zenith Wire Company, of Jamesville, N. Y., has been incorporated with a capital stock of $100,000 by W. A. Beattie, H. V. Hulison, of Syracuse, and H. Hotaling, of Jamesville. The company proposes to manufacture and deal in electric coils and accessories used on automobiles, general plating, wooden novelties, copper wire, etc.

Trade Publications

Insulator.—Type X strain insulator, made by the Ohio Brass Company, Mansfield, Ohio, is the subject of a recent large folder issued by the company.

Automobile Supplies.—Dealing with automobile supplies both of electrical and other types, Catalog No. 35 of the Central Electric Company, 326 South Fifth Avenue, Chicago, sets forth 160 pages of information interesting to automobile owners and dealers.

Pumping Machinery.—The American Steam Pump Company, Battle Creek, Mich., has assembled within an attractive cover twenty-three of its recent bulletins. Pumps for a wide variety of purposes are illustrated and described, each bulletin being devoted to a special type.

Fans.—The Western Electric Company is mailing a large poster on which are illustrated pictures of suggested window displays for dealers, fac-similes of lantern slides that are offered free to dealers, and other advertising helps that will aid them in creating sales for electric fans.

Lighting Glassware.—A folder is being mailed by the Gleason-Tiebout Company, 71 West Twenty-third Street, New York, referring to its "Albedoglas" bowls. These bowls are said so to modify the light of a tungsten lamp as to produce approximately the equivalent of daylight.

Panels.—Battery-charging panels for two-wire systems, 50 volts to 250 volts, are described and illustrated in Leaflet 3719 issued by the Westinghouse Electric & Manufacturing Company. These panels are for lighting and electric-vehicle charging. Typical diagrams of connections are shown.

Oil Switches.—Type I oil switches made by the Westinghouse Electric & Manufacturing Company are described and illustrated in Leaflet No. 3745. This type of oil switch is intended for use on direct-current or alternating-current series lighting circuits and for controlling small inductive loads.

Mica.—Meirowsky Brothers, 106 Broadway, Jersey City, N. J., have issued a well-printed catalog of sixteen pages referring to their chief product, mica. Interesting information on mica is followed by brief illustrated descriptions of this material in various forms and for different purposes. The catalog contains also a price list.

Ice Making.—The United Ice Improvement Company, 50 Church Street, New York, has issued in pamphlet form a "Practical Talk on Refrigeration," by W. Everett Parsons, in which are pointed out how losses occur, how they may be avoided, and how the efficiency of ice plants may be increased by means of the Parsons "quick-freeze" system.

Motors.—"Doing the World's Work" is the title of a neat little pamphlet issued by the Robbins & Myers Company, Springfield, Ohio, which refers to the work of the small motor made by this company. The many uses in the home, factory and shop to which this small motor can be put are referred to, and some miniature illustrations are printed for showing its wide application.

Molded Insulation.—In an eight-page booklet issued by the Stevenson Company, Wilkinsburg Station, Pittsburgh, Pa., illustrations are shown of Stevenson molded insulation and other molded parts applicable to a wide range of uses. It is said that this insulation combines dielectric properties with lightness, high finish and mechanical strength. Many parts made from the insulation are illustrated.

Rope.—The Blue Book of Rope Transmission, published by the American Manufacturing Company, Noble and West Streets, Brooklyn, New York City, is a practical treatise on rope transmission. Actual examples of rope drives now in service are illustrated, and the descriptions of the varied conditions under which this form of transmission is used are interestingly brought forward. The illustrations are many and excellent.

Electric Trucks.—The General Vehicle Company, Long Island City, N. Y., in a thirty-two-page pamphlet gives interesting information as to its gratuitous co-operative advertising service for central stations. Sample advertisements are reproduced. This service is offered in order to stimulate local interest in electric vehicles. Several pages in the book are devoted to drawings of vehicles used by prominent merchants in all parts of the country.

Personal Mention

Mr. J. C. Ingle, formerly general superintendent of the Keokuk (Ia.) Electric Company, has been promoted to the position of manager of that organization.

Mr. A. D. Ayres, formerly manager of the Keokuk (Ia.) Electric Company, has resigned to accept a position with the Linde Air Products Company of New York City.

Mr. W. Crighton Harris has resigned from the engineering firm of Crighton Harris & Company to become chief engineer of the Titan Storage Battery Company, of Newark, N. J.

Mr. R. L. Flannigan, formerly superintendent of the electrical department of the Quincy Gas, Electric & Heating Company, has been appointed electrical inspector for the city of Quincy, Ill.

Mr. Fred D. Clark, formerly assistant superintendent of the electrical department of the South Penn Oil Company of Folsom, W. Va., has been appointed superintendent vice Mr. A. Clarke resigned.

Mr. Thorndyke Harvey, formerly commercial engineer of the Texas Power & Light Company of Dallas, Tex., has been appointed commercial agent of the Kansas Gas & Electric Company, of Wichita, Kan.

Dr. A. Stansfield, professor of metallurgy at McGill University, Montreal, sailed for Europe on the steamship *Canada* on May 16 to investigate for the Dominion government the operation of electric iron furnaces in Sweden and Norway.

Mr. W. A. Reiber, director and secretary of the Citizens' Light, Heat & Power Company of Johnstown, Pa., has received a leave of absence. During the leave of absence Mr. Reiber will manage the General Construction Corporation, 14 Wall Street, New York City, which will engage in construction and engineering work for public utilities.

Mr. Joseph Johnson, Fire Commissioner of New York City under Mayor Gaynor and campaign manager for Mr. Edward E. McCall, chairman of the Public Service Commission, First District, New York, when the latter ran for Mayor on the Tammany ticket last year, has been appointed chief of the Bureau of Transit of the Public Service Commission, First District, New York, at $7,500 a year. The post was formerly held by an engineer.

Prof. Francis Bacon Crocker, well-known author, educator and engineer and past-president of the American Institute of Electrical Engineers, has received the honorary degree of master of science from his Alma Mater, Columbia University, from which he was graduated with the class of 1882. The master's degree was conferred on May 29 in connection with the celebration of the fiftieth anniversary of the founding of the School of Mines.

Mr. H. R. Wetherell, the new president of the National District Heating Association, is superintendent of the steam-heating department of the Central Illinois Light Company, of Peoria. He grew up, so to speak, in the former Peoria Gas & Electric Company, predecessor of the Central Electric Company, under the tutelage of Mr. R. S. Wallace. He has been an active member of the National District Heating Association for several years, and was second vice-president when elected president.

Mr. Gano Dunn, president of the J. G. White Management Corporation and past-president of the American Institute of Electrical Engineers, received the degree of master of science from Columbia University on May 29 in connection with the celebration of the fiftieth anniversary of the founding of the School of Mines. Mr. Dunn was graduated with the class of 1891 and, prior to joining the J. G. White organization, was chief engineer and vice-president of the Crocker-Wheeler Company, of Ampere, N. J.

Mr. James Walter Gillette, who for the past six years has been general manager of the Fort Smith (Ark.) Light & Traction Company, has accepted the position of sales engineer for the Electrical Engineers' Equipment Company, Chicago, Ill. Born June 28, 1871, and educated in the Middle West, Mr. Gillette has had extensive engineering experience with electrical manufacturing companies and central-station companies both in the United States and in South America. At the sixth annual convention of the Arkansas Association of Utility Operators in May, 1913, he was elected president of that body. Mr. Gillette is also a member of the American Institute of Electrical Engineers.

Mr. Arthur L. Mudge, who for some years was chief electrical engineer for the Toronto offices of Messrs. Smith, Kerry & Chace and in charge of the electrical engineering work of the Electric Power Company of Toronto, has engaged in consulting engineering work, including the preparation of reports, valuations and designs, supervision of construction and advice generally with reference to hydroelectric developments, transmission and local distribution systems, street lighting, energy contracts and industrial applications of electricity. Mr. Mudge will continue to have offices with Messrs. Kerry & Chace, Ltd., with whom he has now become associated as manager of their electrical department in the Confederation Life Building, Toronto.

Mr. Chauncey Eldridge, one of the advisory committee of three under whose supervision the Kansas City, Clay County & St. Joseph Railway, Kansas City, Mo., was built by the Wyandotte Construction Company, has resigned from Tucker, Anthony & Company to undertake wireless-telegraph work at San Francisco, Cal. Mr. Eldridge, who was with Tucker, Anthony & Company for about thirteen years, assisted in the construction of the Canton-Akron lines, the Columbus, Buckeye Lake & Newark Railway, the Columbus, Newark & Zanesville Railway, the Mesaba Railway, the Hartford & Springfield Street Railway, the Hartford, Rockville & Manchester Tramway and numerous waterworks. He was a member of the executive board of the Kansas City, Clay County & St. Joseph Railway, but has now been succeeded by Mr. P. L. Saltonstall, the president of the company.

Obituary

Santos J. Rubira, for many years head of the gas and electric company in Mobile, Ala., now controlled by H. M. Byllesby & Company, died May 4, at the age of eighty-two. Born in Spain, Mr. Rubira came to New York in 1870 and five years later migrated to Mobile.

J. A. Sandford, Jr., electrical engineer for the R. Thomas & Sons Company, East Liverpool, Ohio, died in that city on May 21, following an operation in the City Hospital. Mr. Sandford was born in Ware, Mass., Oct. 17, 1879, and was a graduate of the Worcester Polytechnic Institute.

Sir Joseph Wilson Swan, inventor of the incandescent electric lamp, died in London on May 27. He was almost eighty-six years old, having been born in Sunderland, England, Oct. 31, 1828. Sir Joseph spent many years of his life in experimenting with electric lamps and in 1879 succeeded in producing an incandescent lamp. His first lamp (1860) had a carbon filament which he made by packing a strip of thin cardboard with powdered charcoal in a crucible and subjecting it to great heat. This was placed in a glass bulb from which the air was afterward exhausted and a current of electricity applied from wet batteries. His commercial lamp had filaments of cotton threads parchmentized by the action of sulphuric acid. He was the inventor of many other electrical devices, including a miner's safety lamp and an electric meter. Sir Joseph was also widely known as the inventor of the dry plate for photographic uses. He was educated at a private school and received the degree of doctor of science from Durham University. Although a chemist by profession, he was not without honor in other walks of life. He was past-president of the Society of Chemical Industry, past-president and honorary member of the Institution of Electrical Engineers, past-president of the Faraday Society, vice-president of the Senate of University College, London, and life governor of the college. To him were awarded the Hughes medal of the Royal Society for his invention of the electric incandescent lamp and various improvements in the practical applications of electricity in 1904, the Albert Medal of the Royal Society of Arts in 1905, the Progress medal of the Royal Photographic Society, and the gold medal of the Society of Chemical Industry. He was knighted in 1904.

Construction

New England

FITCHBURG, MASS.—Plans are being prepared by the Fitchburg Gas & El. Co. to extend its transmission lines to Ashby and Townsend, where the company has recently secured franchises.

SOUTH HADLEY, MASS.—The town of South Hadley has entered into a contract with the Gas and Electric Department of the city of Holyoke by which the municipal electric plant in Holyoke will supply electricity to operate the local municipal electric system.

SPRINGFIELD, MASS.—Plans are being considered by the city officials and Prof. Clifford for a new lighting system for Court Square. It is understood that the present cluster lamps will be replaced with new magnetite arc lamps. An order for 50 additional arc lamps for the business section will be presented to the City Council.

PASCOAG, R. I.—The taxpayers have voted to contract with the Rhode Island Pwr. Transmission Co., a subsidiary of the Connecticut River Pwr. Co., for electricity to operate the municipal electric-light system for a period of 20 years, and to appropriate $8,000 for the installation of equipment to utilize the energy here.

GROTON, CONN.—The Water and Light Commissioners are contemplating erecting a transmission line to Groton Long Point to furnish electrical service. The cost of the work is estimated at $3,000. Bids for construction of line have been asked for.

NEW LONDON, CONN.—The Connecticut Pwr. Co., of New London, is extending its lines to Goshen, Great Neck, Pleasure Beach and Millstone to furnish electrical service in those places.

NORWALK, CONN.—Bids will be received by the district committee, third district, of the the city of Norwalk, at its office at the power station, East Norwalk, Conn., until June 10 for construction of power plant complete and furnishing equipment. The units involved will embrace not less than two 75-hp gas engines and gas producers, two 50-kw generators, switchboard and other equipment, with optional proposals on 100-hp gas engines with corresponding producers, generators, etc. Complete plans and specifications can be obtained on application to the district committee, East Norwalk, or to Joseph B. Rider, consulting engineer, 29 Broadway, New York, N. Y. William H. Sniffen is chairman of committee.

Middle Atlantic

BROOKLYN, N. Y.—Bids will be received by C. B. J. Snyder, superintendent of school buildings, Department of Education, corner of Park Avenue and Fifty-ninth Street, New York, N. Y., until June 8, for installing electric euipment in new Public School 48, on Eighteenth Avenue, between Sixtieth and Sixty-first Streets, borough of Brooklyn. Blank forms, plans and specifications may be obtained or seen at the above office and also at the branch office, 131 Livingston Street, Brooklyn.

BUFFALO, N. Y.—Plans have been completed for the erection of a substation to be erected at 70 Benton Street for the Buffalo General El. Co., at a cost of about $20,000.

GOVERNOR'S ISLAND, N. Y.—Bids will be received until June 16 for rewiring and furnishing new electrical fixtures in various buildings on Governor's Island. Information furnished on application to department quartermaster.

NEW YORK, N. Y.—The Public Service Commission has awarded contracts for two tunnels to Brooklyn and the crosstown line in Canal Street, Manhattan. The contract for the construction of tunnels was awarded to the O'Rourke Engineering Construction Co., and to Booth & Flinn, on their combined bids of $12,444,725, of which $5,974,809 is for the Brooklyn Rapid Transit tunnel, and $6,469,916 for the Interborough tunnel. The Underpinning & Foundation Co. secured the contract for building the Canal Street crosstown subway for $1,822,494.

NIAGARA FALLS, N. Y.—The Board of Public Works has awarded the Buffalo & Niagara Falls El. Lt. & Pwr. Co. a contract to light the city for a period of five years from Jan. 1, 1914. The present street arc lamps are to be replaced with new magnetite arc lamps within the next two years.

PORT JERVIS, N. Y.—The Port Jervis Lt. & Pwr. Co. has purchased a site on which it will soon erect a new power house, to cost about $100,000. The company has secured the contract to furnish electricity for lamps and motors at the Otisville Sanatorium, and also has decided to extend the electric railway system to Milford.

CALLENSBURG, PA.—Steps have been taken by the Clarion River Pwr. Co. toward the construction of three dams on the Clarion River. Preliminary surveys along the river are being made by C. C. Frick, civil engineer, of Kittanning. The company has begun work on the construction of an office building in Callensburg, where headquarters will be established.

CARBONDALE, PA.—The Council has awarded the Scranton El. Co., of Scranton, a contract for lighting the streets and public buildings for a period of five years. The present arc-lamp-lighting system will be replaced with incandescent street lamps. The company also agrees to furnish electricity for a police alarm system that the Council is considering installing in the near future.

PHILADELPHIA, PA.—The contract for the construction of the transmission station in Chestnut Hill, at Moreland and Germantown Avenues, for the Philadelphia El. Co. has been awarded to Charles Gilpin. The building will be 50 ft. by 80 ft., and will cost about $50,000.

PITTSBURGH, PA.—The Pittsburgh, Butler & Harmony Ry. Co. has begun work on the construction of a new power plant in the old organ works at Morado. This plant, when completed, will furnish electricity to operate the cars on the new line from Ellwood City to Beaver Falls.

SAYRE, PA.—Contracts have been placed by the Sayre El. Co. for two 750-kw turbo-generators and a 300-kw motor-generator set.

MERCHANTVILLE, N. J.—The Common Council has approved a measure providing for the installation of new 32-cp and 80-cp lamps on Maple Avenue and 32-cp lamps in other sections of the borough.

TRENTON, N. J.—The Public Service El. Co. is contemplating the construction of a new substation on Adeline Street, which will furnish service in the Chambersburg district.

WOODBURY, N. J.—Bids will be received by the City Council until June 16 for lighting the streets of the city for a period of three or five years. Arthur Starr is city clerk.

MILFORD, DEL.—A permit has been granted for the erection of an addition to the power house of the L. D. Caulk Co., manufacturer of dental supplies. C. C. Buck, Main Street, Camden, N. J., is the architect.

ELKTON, MD.—The Wilmington & Philadelphia Trac. Co., of Wilmington, is reported to have entered into a contract with the Home Mfg. Lt. & Pwr. Co., Elkton, to furnish electricity here. The transmission lines will be extended from Newark.

FREDERICK, MD.—The Hagerstown & Frederick Ry. Co., of Frederick, is negotiating for the purchase of the property of the Frostburg Illg. & Mfg. Co., which furnishes electricity in Frostburg and vicinity. The railway company is reported also to be negotiating for a water-power development of 50,000 hp rating near Cumberland. The company is still undecided whether to purchase this development or to build a large plant in Cumberland and transmit electricity to its patrons in Allegany County.

FAIRMONT, W. VA.—The Monongahela Valley Trac. Co., of Fairmont, has contracted with the Consol. Coal Co., of Fairmont, to supply additional electricity to operate its system. The Consol. Coal Co., it is reported, will begin work on the installation of a 1000-kw gas-engine-driven generating unit, orders for which have already been placed. R. L. Kingsland is superintendent of the power and mechanical department of the coal company. James O. Watson is general manager of the Monongahela company.

FOLLANSBEE, W. VA.—Work will soon begin on the addition to the electric-light plant at the mill. A new turbine will be installed, also a dry vacuum pump and an air compressor, to be used in connection with the new mills now under construction.

EMORY, VA. — Edmundson Brothers have secured the contract to build a hydroelectric power plant on river about 3 miles from Emory. The proposed plant will furnish electricity for lamps and motors in nearby towns.

WASHINGTON, D. C.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until July 8 for repairs to the mechanical equipment at the United States Treasury, Winder and Butler Buildings, Washington, D. C. For details see proposals columns.

WASHINGTON, D. C.—Bids will be received at the office of the United States Reclamation Service, 605 Federal Building, Los Angeles, Cal., until July 14 for furnishing one vertical, alternating-current generator for the Salt River project, Arizona. For particulars address the United States Reclamation Service, Los Angeles, Cal., or Washington, D. C. F. H. Newall is director.

North Central

ADRIAN, MICH.—Bids will be received by Rolla L. Taylor, treasurer of the Board of Control of the State Industrial Home for Girls, until June 16 for electric wiring in the new hospital addition about to be erected. C. F. Matthes & Son, of Adrian, are the architects.

BOYNE CITY, MICH.—The Boyne River Pwr. Co. is planning to replace the present street-lighting system with new arc lamps.

CLARKSTON, MICH.—Edwin Denby, of Detroit, has applied to the Town Board of Independence for a franchise to erect an electric distributing system in the township of Independence.

DETROIT, MICH.—Plans, it is reported, are being prepared by William F. Goodrich, architect, 310 Sun Building, for a summer hotel (800 rooms) at Grosse Point Shores. A power plant will be erected in connection with the hotel.

DETROIT, MICH.—Bids, it is reported, are now being received for the electrical work in connection with the new building for the Farrell estate on Griswold Street, 12 stories high, 100 ft. by 122 ft., at a cost of $250,000. Rogers & Bonnah are the architects.

DETROIT, MICH.—The contract for the erection of a substation at Moran and Milwaukee Avenues, 50 ft. by 130 ft., for the Edison Illg. Co. of Detroit, has been awarded to Albert A. Albrecht & Co., of Detroit. The Albrecht company will also erect another substation for the Edison company at Hyde and Waterloo Streets, same dimensions.

DETROIT, MICH.—The Detroit Edison Co. is reported to have purchased the plant of the Murphy Pwr. Co., corner of Wayne and Congress Streets. By this transaction the Edison company has secured complete control of the steam-heating, electric and power service in the downtown section of the city. A new power house, it is understood, is to be erected at the corner of Congress and Cass Avenues.

DETROIT, MICH.—The contract for general electrical equipment, including a new transformer house, for the cold-storage plant of the People's Ice Storage Co., on Grand Avenue, has been awarded to the John Templeton Co. The Templeton company also secured the contract for general electrical equipment for the six-story building for the H. R. Leonard Furniture Co., at Woodward and Columbia Streets.

EAST JORDAN, MICH.—The East Jordan Lt. & Pwr. Co. expects to install within the next 30 days one tandem compound Ideal engine with condenser belted to a 100-kw Bullock generator for light load outfit; also to purchase about 1000 ft. of 2200-volt, three-wire and four-wire conductor. L. G. Balch is superintendent.

FLINT, MICH.—The board of managers of the Hurley Hospital has decided to ask the City Council for an appropriation of $9,000 for the installation of a new power plant at the hospital.

FREMONT, MICH.—Within the next three months the Board of Electric Light and Water Works Commissioners expects to purchase one 150-kw or 200-kw, three-phase, 60-cycle, alternating-current generating unit complete; also within the next six months to purchase one car load of 30-ft. (7-in.-top) cedar poles. H. W. Schoolmaster is superintendent.

ISPHEMING, MICH.—The City Council has authorized an expenditure of $5,955 for the installation of ornamental lamps and asphalt construction.

WATERFORD, MICH.—Application has been made to the Town Board by Edwin Denby, of Detroit, to erect transmission lines to distribute electricity in this town.

CANTON, OHIO.—Plans are being considered by Mayor Stolberg for replacing the present arc lamps now in use for incandescent cluster lamps mounted on iron standards throughout the city.

CANTON, OHIO.—The Canton El. Co. has been granted a permit to erect a one-story brick and transformer house at its plant on Third Street, to cost $4,000. W. C. Anderson is general manager.

CINCINNATI, OHIO.—Electrical machinery and equipment will be installed in the garage which will be erected for the Fischer Auto & Service Co. at 916-920 Race Street. The cost of building and equipment is estimated at $50,000.

CINCINNATI, OHIO.—An electric power plant, it is reported, will be installed in connection with the new addition to the plant of the Western Methodist Book Concern, which is to be erected by the Ferro Concrete Co., of Cincinnati.

CINCINNATI, OHIO.—Considerable electrical equipment, including motors, etc., will be used in the annex to the Christ Hospital, which is to be erected in the near future, at a cost of about $200,000. E. E. Shipley, chairman of the hospital committee, has charge of the matter.

CINCINNATI, OHIO.—The Ford Motor Car Co., of Detroit, Mich., has awarded the general contract for the construction of its assembling plant in Cincinnati to the Irwin-Leighton Co., of Philadelphia, Pa. The cost of the plant is estimated at about $250,000. A large amount of electrical equipment will be required.

DAYTON, OHIO.—An electric power plant, it is understood, will be installed in connection with a large apartment house to be erected by the Gaddis Apartment Co., recently incorporated with a capital stock of $125,000.

DAYTON, OHIO.—The Ohio State Tel. Co. (newly organized) will make improvements and extensions to its service in Toledo, involving an expenditure of about $300,000. A large number of wires will be placed underground.

DAYTON, OHIO.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until June 26 for the installation of two electric passenger elevators, three hydraulic lifts and a pumping plant in the United States post office and court house in Dayton. For details see proposals columns.

ELYRIA, OHIO.—A resolution has been introduced into the City Council authorizing all wires on Broad and Court Streets and Middle Avenue placed in underground conduits. The installation of a cluster-lamp lighting system in the principal thoroughfares is also under consideration.

FREMONT, OHIO.—Judge Garver has authorized Budd Jones, receiver for the Sandusky River Pwr. Co., to issue receivers' certificates to the amount of $50,000, the proceeds to be used for improvements to its water-power plant south of Fremont.

LOGAN, OHIO.—Investigations are being made by Arthur D. Foster and Francis R. Weller, who recently purchased the Logan electric-light and power system from the Aracoma Coal Co., for the purpose of selecting a site for the new power house to be erected here in the near future. Arrangements, it is understood, have been completed for the erection of a new generating station and other improvements to the service.

MIDDLEPORT, OHIO. — The Village Council has granted the Mutual El. Lt. Co. an extension of its franchise for a period of 25 years and a 10-year contract to furnish electricity to the village.

NEW CONCORD, OHIO.—Bonds to the amount of $2,500 have been sold by the town of New Concord, and arrangements will soon be made for the installation of a small electric plant.

NORWOOD, OHIO.—Bids, it is reported, will soon be asked for electric work in the new city hall. Other contracts have been awarded.

OSBORN, OHIO.—The municipal electric-light plant has been purchased by the Dayton Pwr. & Lt. Co. for $3,500. The local plant, it is understood, will be dismantled and used as a substation by the Dayton company.

POMEROY, OHIO.—The City Council has granted the Mutual El. Lt. Co., of Middleport, a franchise to furnish electricity for lamps and motors in Pomeroy.

UPPER SANDUSKY, OHIO.—The Hardin-Wyandot Ltg. Co., through a taxpayer, has secured a temporary injunction against the Mayor and other officials, restraining them from selling the issue of $25,000 in bonds authorized for the installation of a municipal electric-light plant.

YOUNGSTOWN, OHIO.—H. W. Jones, consulting engineer, of Cleveland, has been engaged to prepare preliminary plans for a municipal electric-light plant for this city and also to devise and prepare plans for a new street-lighting system for the city.

LOUISVILLE, KY.—The Louisville Gas & El. Co. is extending its transmission line from Anchorage to Crestwood, a distance of 12 miles. The company proposes to furnish electricity to light the streets and residences of several small towns along the line. It will also probably furnish electrical service to the Kentucky Confederate Home at Pewee Valley.

BURLINGTON, IND. — Earl Hearn, owner of the local electric-light plant, has applied to the Public Service Commission for permission to sell his plant to the Indiana Rys. & Lt. Co., of Kokomo, for $3,500. The Indiana company will furnish electricity to operate the local plant from its high-tension transmission lines.

CHICAGO, ILL.—The Chicago Tel. Co. contemplates an expenditure of $750,000 to improve its telephone service between Chicago and North Shore towns and inland points in Lake, Cook and McHenry Counties. About 10,000 miles of new line will be erected.

CHICAGO, ILL.—Bids will be received by the clerk of the Sanitary District of Chicago, Room 700, 910 South Michigan Avenue, Chicago, until June 11, for furnishing alternating-current synchronous-condenser apparatus for a continuous capacity of not less than 2000 kva or more than 2500 kva. For details see proposals columns. Thomas A. Smyth is president of board of trustees.

CLINTON, ILL.—A special election will be held on June 10 to vote on the proposal to make a contract with the Clinton Gas & El. Co. to furnish electricity to operate the pumping station of the municipal waterworks system for a period of 10 years; also to vote on the proposition to issue $2,000 in bonds to construct and equip a 12-in. well at the municipal water-works.

GEORGETOWN, ILL.—The contract for construction of the new township school has been awarded to Herbert B. Krauel, at about $36,000. Contracts for lighting, heating and electrical work will be let separately and will amount to about $9,000.

GREAT LAKES, ILL.—Bids will be received at the Bureau of Yards, Navy Department, Washington, D. C., until June 13 for construction of two 400-ft. steel towers for the radio station at the naval training station, Great Lakes. Plans and specifications may be obtained upon application to the bureau upon deposit of $10, to be refunded upon return of same. H. R. Stanford is chief of bureau.

PLANO, ILL.—Preparations are being made by the Illinois Northern Utilities Co. for the installation of a new street-lighting system in Plano to cost about $10,000. The plans provide for incandescent lamps erected on 4-ft. goose-neck fixtures on poles 16 ft. above the street level, maintained by overhead wires. The work will be done by the company. L. E. Marshall, of Dixon, is general superintendent.

PRINCETON, ILL.—The City Council is reported to be considering two propositions to increase the output of the municipal electric-light plant. One is to install another generating unit in the municipal electric-light plant and the other is to contract with the Spring Valley Utilities Co., of Spring Valley, to erect a transmission line into the city.

QUINCY, ILL.—The Citizens' Water Works Co., of Quincy, is contemplating the installation of electrically driven pumps in its pumping plant and purposes to secure electricity from the plant at the Keokuk dam to operate the same.

MERRILL, WIS.—The report of the special lighting committee recommends that the Council contract with the Merrill Ry. & Ltg. Co. for a period of 10 years and that an engineer be engaged to prepare plans for a street-lighting system and to superintend the installation of same.

UNION GROVE, WIS.—The contract for the construction of the new electric-light plant in Union Grove has been awarded to the Globe El. Co., of Milwaukee.

BARNESVILLE, MINN.—Arrangements are being made for the installation of an incandescent street-lighting system, consisting of 34 standards mounted with five-lamp clusters (one 60-watt and four 40-watt lamps), to be maintained by underground wires, to cost about $2,500. Bids have already been received for the work. H. H. Pierce is superintendent of the municipal electric-light plant.

CARLTON, MINN.—Plans, it is reported, have been approved by the Village Council for improvement of the street-lighting system, which include the installation of many new lamps.

CLINTON, MINN.—At a special election held recently the proposition to grant a franchise for the installation of an electric-light system was carried.

HASTINGS, MINN.—Within the next 12 months the Hastings El. Lt. & Wtr. Pwr. Co. expects to build an 80-ft. concrete dam and install generating machinery and equipment; also to purchase two turbines, two generators and two waterwheel governors. The property of the Hastings El. Lt. & Wtr. Co. has been purchased by the River Falls Pwr. Co. The main office of the company is at Hastings.

HASTINGS, MINN.—Bids will be received by the State Board of Control, State Capitol Building, St. Paul, until June 15, for construction of infirmary cottage No. 9 and the superintendent's residence, State Asylum, at Hastings, including general contract work, heating and ventilating, plumbing and electrical work, in accordance with plans and specifications furnished by C. H. Johnston, architect, 715 Capital Bank Building, St. Paul. Bids will be received collectively and separately. Plans may be seen at the St. Paul and Minneapolis Builders' Exchanges, at the office of the superintendent of the institution, Hastings, and at the office of the State Board of Control, State Capitol Building, St. Paul.

HIBBING, MINN.—L. A. Larson, engineer, of Duluth, estimates the cost of a new municipal electric-light plant at $150,000.

PAYNESVILLE, MINN. — Within the next few months the Water and Light Commission expects to erect a water tank and tower, probably steel. John H. Haugen is recorder.

PRINCETON, MINN. — The Building, Light and Water Commission is expecting to erect within the next eight months about eight blocks of distribution line and a tower for city water supply; also to purchase within the next 30 days a water tank and tower. O. B. Randall is superintendent.

SLAYTON, MINN.—It is reported that Victor Klinger has submitted a proposal to install an electric-light plant in Slayton.

ALTOONA, IA.—The Gibson El. Co. expects to purchase within the next three months poles, wire, street hoods and reflectors for the new incandescent multiple street-lighting system. G. T. Gibson is proprietor.

CORWITH, IA.—The town of Corwith contemplates securing electricity from the plant in Humboldt, provided the intermediate towns of Livermore and Luverne also vote favorably on similar propositions.

DES MOINES, IA.—If the franchise being prepared by Emil G. Schmidt, president of the Des Moines Ry. Co., is approved by the City Council, extensions and improvements will be made to the city railway system, involving an expenditure of $1,500,000 within the next three years.

EARLVILLE, IA.—Plans are being prepared by Nash & Co., of South Bend, Ind., for the construction of a municipal electric-light plant and pumping station.

GREENE, IA.—The Greene El. Lt. & Pwr. Co. has recently installed a 200-amp-hr. chloride accumulator storage battery. R Miner is secretary

HARCOURT, IA.—At a special election held recently the proposal to grant the Central Iowa Lt. & Pwr. Co., of Boone, Ia., a 20-year franchise to furnish electricity for lamps and motors in Harcourt was carried.

BLUE SPRINGS, MO.—At an election held recently the proposal to grant Nickols & Cannon a 20-year franchise to construct and operate an electric-light plant in Blue Springs was carried.

BOWLING GREEN, MO.—The Pike County El. Lt. & Pwr. Co., of Bowling Green, expects to purchase within the next 12 months one carload of poles, 5000 ft. No. 8 and No. 10 wire and 20 meters. C. K. Lee is manager.

CLARENCE, MO.—The City Council is considering the question of calling an election to submit the proposal to issue bonds for the purchase of a new engine and generator for the municipal electric-light plant. Don McIntire is superintendent.

JOPLIN, MO.—Within the next 30 days the Empire District El. Co., of Joplin, is expecting to erect a transmission line to Columbus and Scammon, Kan., a distance of 13 miles; also to erect a 750-kw substation in Scammon. George E. Hayler, Jr., is general superintendent.

KANSAS CITY, MO.—The Metropolitan St. Ry. Co., of Kansas City, it is reported, will install a 10,000-kw turbo-generator set in its power plant, for which a contract has been awarded.

KAHOHA, MO.—Within the next four months the Board of Public Work expects to erect a new power house, 70 ft. by 30 ft., and to purchase one 60-hp boiler, one 90-kw, single-phase, 60-cycle generator, one 150-hp to 200-hp engine, a motor-driven centrifugal pump, water heater, car load of poles and a series street-lighting system. On May 26 the city voted to issue $11,000 in bonds for extensions to the municipal lighting system. A. H. Frazer is superintendent.

MOBERLY, MO.—The Moberly Lt. & Pwr. Co. expects to purchase two General Electric 50-lamp rectifier, 4-amp sets within the next 30 days. J. C. Reighard is manager.

OAK GROVE, MO.—Application has been made to the City Council by W. H. George

for a franchise to install an electric-light and ice plant in Oak Grove.

ST. LOUIS, MO.—Within the next six months the Laclede Gas Lt. Co., of St. Louis, expects to install overhead and underground feeder lines; also to purchase boilers, generators and exciters, coal, coke and ash-handling machinery, underground conduit, cable, etc. George B. Evans is assistant general manager and chief engineer.

ST. LOUIS, MO.—The Laclede Gas Co., of St. Louis, has begun work on its new by-product coke plant, the first unit to be of 56 ovens. The project will include the erection of a gas holder of 1,000,000 cu. ft. capacity, a water-pumping station, a central power plant, ammonia tanks, and machine. The cost of the entire work is estimated at $3,000,000.

SALEM, MO.—The Salem Lt. & Pwr. Co. is expecting to purchase a 20-kw generator, posts and also some electrical appliances, including vacuum cleaners, cooking apparatus, etc. W. P. Elmer is general superintendent.

UNIVERSITY, MO.—The University City Improvement Association has appointed a committee to make investigations as to the feasibility of establishing a municipal electric-light plant in University.

SIOUX FALLS, S. D.—Plans, it is reported, have been prepared for a new street-lighting system in Sioux Falls.

WESSINGTON, S. D.—The Town Council has voted to install a municipal street-lighting system in Wessington.

ASHLAND, NEB.—Within the next six months the Ashland Lt., Mill & Pwr. Co. expects to install a 60-hp to 75-hp gasoline or oil engine as auxiliary to water-power plant. F. E. White is secretary and treasurer.

FREMONT, NEB.—The City Council is considering the question of installing a heating plant in connection with the municipal light and power plant. The cost of the equipment is estimated at $40,000.

NORTH BEND, NEB.—The installation of a municipal electric-light plant is under consideration.

NORTH PLATTE, NEB.—Within the next six months the North Platte Gas & El. Co. expects to erect a new power house complete and to purchase a complete series incandescent street-lighting system, consisting of 15 lamp standards; also to purchase within the next two months two 300-hp water-tube boilers and two engine-driven alternators having a rating of about 800 kw. C. R. Morey is manager.

PAWNEE CITY, NEB.—Within the next two months the city of Pawnee City expects to erect 30 miles of transmission line and to build within the next three months a brick chimney, 100 ft. high; also to purchase within the next six months one 100-hp high-speed engine. T. H. Lawrie is superintendent.

SUPERIOR, NEB. — Preparations are being made by the Southern Nebraska Pwr. Co., of Superior, for the construction of a power plant on the Republican River, near Superior. The equipment will include two Murray boilers, of 150 hp each, Murray Corliss engines, two 40-in. and two 35-in. "Samson" waterwheels, one Lombard waterwheel governor for the 40-in. waterwheels, one Rock Island waterwheel governor and one 250-kw General Electric generator. The company now furnishes electricity in Superior, and when the plant is completed it will extend the service to about 20 other towns. Both steam and water plants will be enlarged, but plans are not yet completed. A. C. Arends, of Omaha, is engineer in charge of work. D. Guthrie is president.

VALENTINE, NEB.—The City Council, it is reported, is considering issuing bonds for repairing dam and placing the electric plant in operation.

VALLEY, NEB.—Within the next few months the village of Valley expects to purchase a regular supply of street lamps and a few coils of Nos. 8 and 10 weather-proof wire. Albert C. Hedburg is village clerk.

COLDWATER, KAN.—Bids will be received by W. F. Baker, city clerk, until June 25, for furnishing material and installing machinery in the municipal electric-light plant and water-works as follows: (1) For furnishing and installing one 100-hp oil engine; (2) one 75-kw generator, switchboard and instruments for generator, one 25-hp motor and equipment for pump; (4) one 10,000-gal. fuel-oil storage tank. For details see proposal columns. L. A. Baldwin is engineer for the city.

McPHERSON, KAN.—Within the next two months the electric light and water works commissioners expect to install oil burning equipment in the municipal electric-light plant. Philip R. Dunton is superintendent.

Southern States

CLINTON, N. C.—The local electric-light plant was recently destroyed by fire, causing a loss of about $7,000. The town will be without electric service until the plant is rebuilt.

KINSTON, N. C.—At an election to be held June 23 the proposal to issue $100,000 in bonds, the proceeds to be used for improvements to the municipal electric-light plant, roads and street works, will be submitted to the voters.

TYRON, N. C.—The Tyron El. Ser. Co. is extending its transmission line from Tyron, N. C., to Landrum, S. C. Material for this extension has been purchased.

McBEE, S. C.—Preparations are being made by W. L. McCoy for the installation of an electric-light plant, contracts for which will be let about June 15. The plant will be situated on Cedar Creek. The equipment will include a Leffel waterwheel. About 50 100-watt lamps and 750 20-watt lamps will be used. Reported in the issue of May 30 that a dam was being built on Cedar Creek preparatory to installing an electric plant.

COLUMBUS, GA.—The management of the Swift Spinning Mills has closed a contract for energy with which to operate its mills. The mills will be equipped with electrically driven machinery throughout.

ST. MARY'S, GA.—The St. Mary's Ice & Lt. Co., recently incorporated, contemplates the installation of an electric-light plant the latter part of the year. The company is now building an ice factory. S. C. Townsend and others are interested.

SAVANNAH, GA.—The Savannah Ltg. Co. is reported to have engaged the Schofield Engineering Co., of Philadelphia, Pa., to design and supervise the remodeling of power plant and substations. Additional equipment (to cost about $200,000), it is reported, will be installed.

DELRAY, FLA.—The Council has decided to submit the proposal to issue bonds for an electric-light plant and water-works system to the voters.

GULFPORT, FLA.—The City Council has granted F. J. Davenport and associates a 30-year franchise to construct and operate an electric-light and power plant and water-works system in Gulfport.

KISSIMMEE, FLA.—Preparations are being made to install an engine and generator in the municipal electric-light plant. Equipment, it is understood, has been purchased.

MELBOURNE, FLA.—Work will soon begin on the installation of an electric-light system in Melbourne, bonds for which have recently been sold.

CAMDEN, TENN.—J. S. Madey & Son, of Mayfield, it is reported, contemplate the installation of an electric-light plant in Camden.

BAY MINETTE, ALA.—The installation of electric-lighting and water-works systems in Bay Minette is under consideration.

BIRMINGHAM, ALA.—The Birmingham Ry., Lt. & Pwr. Co. has entered into a contract with the Alabama Pwr. Co., under which the former will use energy generated at the plant at Lock 12 on the Coosa River. The contract will go into effect as soon as the tower transmission line is completed.

FOLEY, ALA.—The Swanstrom Brothers' Mill Co., of Foley, it is reported, contemplates the installation of an electric plant to furnish electricity for lamps and motors for its mill.

GADSDEN, ALA.—The City Council has granted the Alabama Pwr. Co., of Birmingham, a franchise to erect a transmission line on Second Street in Oak Park addition to enable the company to furnish electricity to the steel mills of the Gulf States Steel Co.

VICKSBURG, MISS.—The city of Vicksburg has awarded the Vicksburg Lt. & Pwr. Co. a new contract for street-lighting for a period of five years, under which the company agrees to replace the 226 incandescent lamps of 60 cp with 80-cp lamps, also to install at its own expense before Dec. 1, 1914, 31 ornamental posts, each carrying three-lamp clusters. C. G. Johnson, is manager of the Vicksburg company.

HOT SPRINGS, ARK.—The Railroad Commission has granted the Ouachita Pwr. Co. of Arkansas permission to construct a hydroelectric power plant on the Ouachita River, about 6 miles from Hot Springs. The company proposes to develop from 6000 hp to 7000 hp at its principal power dam, which will be situated about 1¼ miles from the Rock Island track, from Lawrence station and Essex Park race track, and to locate a large cotton mill near its power plant. The remainder of the energy generated at the plant will be transmitted to Hot Springs, Benton, Malvern, Little Rock and other points within a radius of 150 miles.

STUTTGART, ARK.—A petition has been presented to the City Council favoring municipal ownership of the water and light plant. The Council has passed an ordinance forming an improvement district to finance the plant.

WASHINGTON, ARK.—The Haygood Seminary Lt. & Trac. Co., of Washington is installing an electric plant to furnish electricity for lighting the streets, and for residential and commercial lighting, and also for motors in Washington. All the equipment has been purchased excepting a 20-hp oil engine. M. Betton, of Washington, has charge of the engineering work. R. Carter is president.

ABITA SPRINGS, LA.—The City Council is reported to be considering a proposal submitted by a local company to furnish electricity for lighting the town.

HENRYETTA, OKLA.—The contract for construction of power house, it is reported, has been awarded to Paul E. Meeting. The Tonkawa Construction Co. has been awarded the contract for equipment for plant.

DALLAS, TEX.—The Dallas El. Lt. & Pwr. Co., it is reported, is planning to enlarge its power plant and place its wires underground in the downtown district, at a cost of about $1,000,000. The Stone & Webster Management Association, of Boston, Mass., is general manager.

DALLAS, TEX.—Plans are being prepared by the Northern Texas Utilities Co., of Dallas, for the construction of a power plant to furnish electricity in several towns, contracts for which will be awarded in about 60 days. W. C. Woodlief, Box 1615, Dallas, is engineer in charge; Hiram Grosman is president.

NIXON, TEX.—The installation of an electric-light plant in Nixon is under consideration. C. D. Pucket is reported interested in the project.

SAN ANGELO, TEX.—The San Angelo Wtr., Lt. & Pwr. Co. has inaugurated a new-business department and would like to receive prices and catalogs on signs, motors, electrical appliances, etc. W. A. Guthrie is general manager.

SEGUIN, TEX.—Preparations are being made by the Guadalupe Pwr Devel. Co. for the construction of five power dams on the Guadalupe River immediately, the first to be located 6 miles below Seguin and the other four at points further up the stream. These five dams, it is estimated, will develop about 10,000 hp. Nine other dams will be built within the next eight years capable of developing 20,000 hp. The company has been granted a permit by the State board of engineers for the construction of these dams, and also the right to the power that is produced by damming water above the level of the stream. Large storage reservoirs will be erected. Electricity will be transmitted to towns and cities in southwest Texas, including San Antonio. Guy C. Simpson, of San Antonio, is engineer in charge.

SONORA, TEX.—Contract, it is reported, has been awarded by J. D. Eaton & Son, owners of the local water-works system, to the West Brook-Broome El. Co., of San Angelo, to install an electric-light plant, to cost from $5,000 to $7,500.

Pacific States

MOLSON, WASH.—Application has been made to the County Commissioners of Okanogan County by David Moore for a franchise to erect transmission lines along the county roads of Okanogan County and the streets of Molson and also to operate a water-works system in Molson.

POMEROY, WASH.—The Pacific Pwr. & Lt. Co., of Portland, it is understood, will begin work immediately on improvements to its local electric plant.

REPUBLIC, WASH. — Application has been made to the Commissioners of Ferry County by F. M. Shields and M. McKain, of Spokane, for a franchise to erect an electric transmission line from Republic to Danville, a distance of 35 miles, to cost approximately $75,000. Energy will be secured from the plant of the West Kootenai Pwr. Co. at Bonnington Falls, B. C.

SPOKANE, WASH.—Petitions have been filed for a new ornamental lighting district, to include the entire length of First Avenue from Bernard to Cedar Street. The plans provide for the erection of ornamental iron posts carrying luminous arc-lamps.

NEHALEM, ORE.—The installation of a municipal electric-lighting system in Nehalem is under consideration.

RIDDLE, ORE.—It is reported that W. Vaughn, owner of the Geer box factory in Riddle, is contemplating the installation of

an electric plant, to furnish electricity for lighting the streets of the city and for commercial and residential lighting.

GREENVILLE, CAL.—The Indian Valley El. Lt. & Pwr. Co., of Greenville, has filed an application with the State Railroad Commission, asking the commission to modify an order made in September, 1912, authorizing the company to issue $81,535 in bonds. The company has issued none of the bonds and wishes now to enter into an agreement with the Great Western Pwr. Co. to take energy at the Big Meadow dam, 13 miles distant from the main station of the Indian Valley company. The agreement, if authorized, will require an outlay of $20,396 for the erection of a transmission line between Greenville and the Big Meadow dam. The company is to change its name to the Plumas Lt. & Pwr. Co., under which name it wishes to issue $80,000 in bonds.

LOS ANGELES, CAL.—Application has been filed with the State Railroad Commission by the Midland Counties Public Service Corpn., of Los Angeles, formerly the Coalinga Wtr. & El. Co., for authority to issue $650,000 in capital stock. Of this amount $410,000 will be used for refunding purposes and $237,627 for new construction.

OAKLAND, CAL.—The Vernon-Rockridge Improvement Club has filed a petition with the City Council asking permission to install 36 electroliers along College Avenue for 13 blocks in the center of the Vernon-Rockridge district and requesting the city to pay for maintenance of the lamps. The cost of the electroliers and lamps is estimated at $4,000, which the club agrees to pay.

REDLANDS, CAL.—The State Railroad Commission has granted the Coachella Valley Ice & El. Co., of Redlands, permission to use the franchise granted by Riverside County to erect electric transmission lines to Coachella and the Imperial Valley. The company has also received authority from the commission to issue $300,000 in bonds.

SANTA BARBARA, CAL.—A petition has been presented to the City Council by A. C. Olney, representing the Chamber of Commerce, asking for the establishment of an assessment district for ornamental lamps on State Street.

SAUSALITO, CAL.—The Board of County Supervisors has granted the Pacific Gas & El. Co. a franchise to erect transmission lines to distribute electricity in Marin County, particularly in Bolinas and in Willow Camp.

BOISE, IDAHO.—Preparations, it is reported, are being made by the Overlook Mining & Development Co. for the construction of a hydroelectric-power plant on its property, about 80 miles from Boise City.

GRANGEVILLE, IDAHO.—Preparations, it is reported, are being made by Supplee & Adams to construct a power plant on the American River, to furnish electricity to the mines in this section and for lighting purposes in Elk City.

SANDPOINT, IDAHO. — Negotiations have been closed between the Northern Idaho & Montana Pwr. Co., of Sandpoint, and the Northern Pacific R. R. Co., whereby the former will furnish electricity to the railway shops of the Northern Pacific company at Kootenai for a period of five years. The contract will take effect as soon as connection can be made by the power company.

WEISER, IDAHO.—We are informed that the Adams County Lt. & Pwr. Co. does not contemplate developing a water-power site on Rush Creek, as reported in the issue of May 9, and is not connected with Weiser in any way. Its place of business is in Cambridge. B. Gustad, of Cambridge, is president and general manager.

PHOENIX, ARIZ.—Surveys of the transmission lines of the Falls Pwr. & El. Co., it is reported, have been completed and work will soon begin on the erection of the system, which will consist of 8 miles of 4000-volt main line and 17 miles of 2200-volt, secondary line and local service for both lamps and motors at 110 volts.

BOZEMAN, MONT.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until July 20 for construction complete, including mechanical equipment, interior lighting fixtures and approaches, of the United States post office at Bozeman. Drawings and specifications may be obtained from the above office or from the custodian of site at Bozeman. O. Wenderoth is supervising architect.

HELENA, MONT.—The Helena Lt. & Ry. Co. is expecting to purchase within the next four months several electric ranges, washing machines and dishwashers. C. A. Bernier is superintendent of electrical department.

SACO, MONT.—The Moore Tel. Co. is contemplating the installation of a municipal electric-lighting plant with sufficient output to maintain 1000 lamps. The plant, when completed, will be turned over to Harry F. Eline.

TORRINGTON, WYO. — Bonds to the amount of $5,000 have been voted to establish an electric light and power plant. Earle H. Reid is city clerk.

KERSEY, COL.—The Home Gas & El. Co. has applied to the Board of Trustees for a franchise to furnish electricity in Kersey for a period of 20 years.

LAHONTAN, NEV.—Bids will be received at the office of the United States Reclamation Service at Fallon, Nev., until June 25 for the lease from the United States of the electric power plant at Lahontan, Truckee-Carson project, Nevada. For particulars address the United States Reclamation Service at Washington, D. C.; Fallon, Nev., or 605 Federal Building, Los Angeles, Cal. A. P. Davis is chief engineer.

CARRIZOZO, N. M.—Plans, it is reported, are being prepared by J. H. Fulmen of the Eagle Mining Co., of Parsons, for the erection of an electric power plant to furnish electricity to operate the machinery in the mines recently acquired by the company, and for a crushing and concentrating plant.

Canada

ATHABASCA, ALTA.—The Mayor has authorized the fire, light and police committee to prepare a report relative to the installation of an electric-lighting system in Athabasca. It is proposed to install the system this year.

EDSON, ALTA.—The town of Edson, it is understood, will soon begin work on the installation of a municipal electric-light plant for which bonds to the amount of $45,000 have been issued.

RED CLIFF, ALTA.—Preparations are being made for extension of the street-lighting system, to cost about $6,000, contracts for which will be let in June. The plans provide for the erection of 100 ornamental iron posts (made by local manufacturer). J. Ellisknith is town engineer.

PRINCE RUPERT, B. C.—The City Council has authorized an expenditure of $34,709 for extensions to the municipal telephone system, and $10,189 for extensions and improvements to the municipal electric-lighting plant. Bids for material and installing same will soon be called for.

REVELSTOKE, B. C.—The contract for water turbine for the municipal hydro-electric-light plant has been awarded to Esher, Wyss & Co., of Vancouver, at $10,300, and for generator, exciter and switchboard to the Canadian Electric Co., at $6,993.

VANCOUVER, B. C.—The J. Z. Lajoie Co., a subsidiary of the Canadian Northern Ry. Co., it is reported will develop the Lajoie Falls to generate electricity to operate trains through the tunnel of the Canadian Northern Railway.

BATHURST, N. B.—Plans are being prepared by the Bathurst Pulp Co. for the construction of a large pulp and paper mill, to be equipped throughout with electrically operated machinery. The power plant will be equipped with three 750-kw, 550-volt alternating-current generators. Mr. McDiarmid, of the Montreal Lt., Ht. & Pwr. Co., of Montreal, is consulting engineer.

PORT HAWKESBURY, N. S.—A movement is under way to establish an electric-light plant in Port Hawkesbury. The Northern Atlantic Fisheries Co. has a 50-kw outfit at its cold-storage plant and it is proposed that the company install a lighting system for the town.

DUTTON, ONT.—The Town Council is reported to be considering the installation of a hydroelectric system.

HAGERSVILLE, ONT.—The Village Council is considering extensions to the electric-lighting system.

NEW TORONTO, ONT.—The application of the Brown's Brass Rolling Mills for 300 hp to operate its mills has been granted by the Hydro-Electric Power Commission of Toronto.

TORONTO, ONT.—Contracts have been awarded by the Hydro-Electric Power Commission of Ontario for the construction of distribution stations in Creemore, Port McNicol, Waubaushene, Strathroy and Tilbury.

TORONTO, ONT.—The Toronto Board of Control has authorized the Toronto Hydro-Electric system to prepare a report on the proposition of establishing a municipal steam plant. It is proposed to sell steam for heating purposes and also to provide a source of power for emergency purposes for the water-works and hydroelectric systems.

COTEAU LANDING, QUE.—The Cedar Rapids Mfg. & Pwr. Co. and the Cedar Rapids Transmission Co., of Coteau Landing, has applied to the Governor-in-Council for authority to erect a transmission line across the St. Lawrence River, joining the line of the St. Lawrence Transmission Co.

MONTREAL, QUE.—At the suggestion of the city officials Mr. Parent, superintendent of lighting, will prepare a report on the cost of installing an electric plant with sufficient output to maintain 500 street lamps for the central district.

THREE RIVERS, QUE.—The installation of an ornamental street-lighting system is being considered by the City Council. The plans provide for arc lamps erected on ornamental iron standards.

ASSINIBOIA, SASK.—The Village Council is considering the installation of a municipal electric-light plant. Murphy & Underwood, of Saskatoon, are engineers.

SASKATOON, SASK.—Tenders will be received by the City Commissioners of Saskatoon until June 20 as follows: (A) For two 4,000,000-gal. motor-driven centrifugal pumps, with switch panels and starting equipment; (B) one turbine-driven centrifugal boiler-feed pump, complete with steam separator, gages and tools; (C) one 75-kw motor-generator exciter; (D) one 600-kw rotary converter and transformers with switchboard panels, etc.; (E) three 400-kw transformers and switch gear equipment; (F) for 17,700 ft. of 11,000-volt cable, partly armored, lead-covered, and partly lead-covered only, and for laying, jointing and connecting up the same; (G) 1 mile of 2200-volt, four-core, 211,600-circ. mil cable and for installation of same in conduit; (H) 9000 ft. of 500,000-circ. mil single-conductor, double-braided weather-proof cable. Specifications, instructions to bidders and forms of tender may be obtained from E. Hanson, city electrical engineer, Saskatoon. F. E. Harrison is Mayor.

WOLSELEY, SASK.—By-laws providing for extensions to the electric-lighting system, etc., will soon be submitted to the ratepayers.

New Incorporations

DOVER, DEL.—The Southern Utah Pwr. Co. has filed articles of incorporation under the laws of the State of Delaware with a capital stock of $600,000. The company proposes to distribute electricity for lamps, heat and motors. The incorporators are E. P. Bacon, H. V. Hoyt and O. P. M. Biereach, of Boise, Idaho.

CHICAGO, ILL.—The Central West Electric Co. has been incorporated with a capital stock of $5,000 by Max W. Zabel, Albert A. Radtke and H. A. Jones.

FULTON, KY.—The Pub. Ser. Co. of Western Kentucky has been incorporated with a capital stock of $140,000 by J. H. Boughton, W. C. Morehead and H. L. Lowe. This company is a consolidation of Fulton El. Lt., Ht. & Pwr. Co., of Fulton, and the Hickman El. Ice & Wtr. Co., Hickman.

RENO, NEV.—The Beaver River Pwr. & Plant Co. has been incorporated with a capital stock of $100,000 by H. R. Waldo, George F. Halliday, O. P. McBiersach, E. P. Bacon and H. V. Hoyt.

VERNON, N. Y.—The Tyler Lt. & Pwr. Co. has been granted a charter with a capital stock of $500. The incorporators are Mary E. Tyler, George E. Capes and Edwin E. Morris.

HASKELL, OKLA.—The Haskell Lt. & Pwr. Co. has been incorporated with a capital stock of $10,000 by C. W. Marston, J. O. Dowdy and R. B. Harris.

DELL RAPIDS, S. D.—The Dell Rapids Lt. & Pwr. Co. has been incorporated with a capital stock of $20,000 by N. C. Draper and others.

MEXIA, TEX.—The Mexia Wtr., Lt. & Pwr. Co. has been chartered with a capital stock of $140,000. The incorporators are W. P. Cook, Joseph Nussbaum and O. H. Brannon.

RICHMOND, VA.—The American Wtr. Wks. & El. Co. has been granted a charter with a capital stock of $25,000,000 for the purpose of owning, operating and building water and electric plants. The officers of the company are: H. Hobart Porter, of New York, N. Y., president; Henry H. Pearce, of New York, N. Y., secretary, and Charles L. Scott, of Hempstead, N. Y., treasurer. The headquarters of the company will be in Richmond.

HAMILTON, ONT., CAN.—The Skootamatta Pwr. & Devel. Co. has been incorporated with a capital stock of $300,000 by H. D. Petrie, S. L. Heaton and M. E. Smith.

Directory of Electrical Associations, Societies, Etc.

ALABAMA LIGHT AND TRACTION ASSOCIATION. Secretary-treasurer, H. O. Hanson, Mobile Gas Co., Mobile, Ala.

AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE. Permanent secretary, L. O. Howard, Smithsonian Institution, Washington, D. C.

AMERICAN ELECTRIC RAILWAY ACCOUNTANTS' ASSOCIATION. Secretary-treasurer, E. B. Burritt, 29 West 39th St., New York.

AMERICAN ELECTRIC RAILWAY ASSOCIATION. Secretary, E. B. Burritt, 29 West 39th St., New York.

AMERICAN ELECTRIC RAILWAY ENGINEERING ASSOCIATION. Secretary, E. B. Burritt, 29 West 39th St., New York.

AMERICAN ELECTROCHEMICAL SOCIETY. Secretary, Prof. J. W. Richards, Lehigh University, South Bethlehem, Pa.

AMERICAN ELECTRO-THERAPEUTIC ASSOCIATION. Secretary, Dr. J. Willard Travell, 27 East 11th St., New York.

AMERICAN INSTITUTE OF CONSULTING ENGINEERS. Secretary, Eugene W. Stern, 101 Park Ave., New York City.

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS. Secretary, F. L. Hutchinson, 33 West 39th St., New York. Board of directors meets monthly. Sections and branches in the principal electrical centers throughout the country. Annual meeting, Detroit, Mich., June 23-25, 1914.

AMERICAN PHYSICAL SOCIETY. Secretary, Prof. A. D. Cole, Ohio State University, Columbus, Ohio.

AMERICAN SOCIETY OF REFRIGERATING ENGINEERS. Secretary, William H. Ross, 154 Nassau St., New York City.

AMERICAN SOCIETY FOR TESTING MATERIALS. Secretary-treasurer, Edgar Marburg, University of Pennsylvania, Philadelphia.

AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS. Secretary, Edwin A. Scott, 29 West 39th St., New York.

AMERICAN WATER WORKS ASSOCIATION. Secretary, J. M. Diven, 47 State St., Troy, N. Y.

ARKANSAS ASSOCIATION OF PUBLIC UTILITY OPERATORS. Secretary, W. J. Tharp, Little Rock, Ark.

ASSOCIATION OF EDISON ILLUMINATING COMPANIES. Secretary, Geo. C. Holberton, Pacific Gas & Electric Co., San Francisco, Cal.

ASSOCIATION OF IRON AND STEEL ELECTRICAL ENGINEERS. Secretary, W. T. Snyder, McKeesport, Pa.

ASSOCIATION OF RAILWAY ELECTRICAL ENGINEERS. Secretary-treasurer, Jos. A. Andreucetti, Chicago & Northwestern Railway, Chicago.

ASSOCIATION OF RAILWAY TELEGRAPH SUPERINTENDENTS. Secretary, P. W. Drew, 112 West Adams St., Chicago.

CALIFORNIA ELECTRICAL CONTRACTORS' ASSOCIATION. Secretary, W. S. Hanbridge, 1408 Merchants' National Bank Building, Los Angeles, Cal.

CANADIAN ELECTRICAL ASSOCIATION. Affiliated with N. E. L. A. Secretary-treasurer, J. H. Larmouth, 610 Confederation Life Bldg., Toronto, Can. Annual meeting, Montreal, Que., June 24-26.

COLORADO ELECTRIC CLUB. Secretary, C. F. Oehlmann. Meets every Thursday at Albany Hotel, Denver, Col.

COLORADO ELECTRIC LIGHT, POWER AND RAILWAY ASSOCIATION. Secretary-treasurer, T. F. Kennedy, 900 15th St., Denver, Col.

COMMERCIAL SECTION, N. E. L. A. Secretary, J. F. Becker, 1170 Broadway, N. Y.

EASTERN NEW YORK SECTION, N. E. L. A. Secretary, C. S. Van Dyck, Schenectady, N. Y.

ELECTRIC CLUB OF CHICAGO. Secretary, Fred M. Rosseland, Monadnock Block, Chicago. Meets every Thursday noon at Hotel Sherman.

ELECTRICAL CONTRACTORS' ASSOCIATION OF GREATER BOSTON. Secretary, R. S. Hale, 39 Boylston St., Boston.

ELECTRICAL CONTRACTORS' ASSOCIATION OF MASSACHUSETTS. Secretary, H. D. Temple, 30 Foster St., Worcester, Mass.

ELECTRICAL CONTRACTORS' ASSOCIATION OF NEW YORK STATE. Secretary, Geo. W. Russell, Jr., 25 West 42d St., New York.

ELECTRICAL CONTRACTORS' ASSOCIATION OF THE CITY OF CHICAGO. Secretary, M. N. Blumenthal, 179 West Washington St. Meets at noon on the second and fourth Wednesday of each month at 424 South Wabash Ave.

ELECTRICAL CONTRACTORS' ASSOCIATION OF STATE OF MISSOURI. Secretary, A. J. Burns, 318 West Tenth St., Kansas City, Mo.

ELECTRICAL CONTRACTORS' ASSOCIATION OF WISCONSIN. Secretary, Albert Petermann, 626 Lloyd St., Milwaukee, Wis.

ELECTRICAL CREDIT ASSOCIATION OF CHICAGO. Secretary, Frederic P. Vose, 1343 Marquette Building, Chicago.

ELECTRICAL CREDIT ASSOCIATION OF PHILADELPHIA. Secretary, John W. Crum, 1324 Land Title Building, Philadelphia, Pa.

ELECTRICAL SALESMEN'S ASSOCIATION. Secretary, Francis Raymond, 125 Michigan Ave., Chicago, Ill.

ELECTRICAL SUPPLY JOBBERS' ASSOCIATION. General Secretary, Franklin Overbagh, 411 South Clinton St., Chicago, Ill.

ELECTRICAL TRADES ASSOCIATION OF CANADA. Secretary, William R. Stavely, Royal Insurance Building, Montreal, Can.

ELECTRICAL TRADES ASSOCIATION OF THE PACIFIC COAST. Secretary, Albert H. Elliott. Harding Building, 34 Ellis St., San Francisco, Cal. Meeting, San Francisco, second Thursday of each month.

ELECTRIC VEHICLE ASSOCIATION OF AMERICA. Executive secretary, A. Jackson Marshall. United Engineering Societies Building, 29 West 39th St., N. Y. Sections in New England, Chicago, Philadelphia and Washington.

EMPIRE STATE GAS AND ELECTRIC ASSOCIATION. Secretary, Charles H. B. Chapin, 29 West 39th St., New York.

FARADAY ELECTRICAL ASSOCIATION. Secretary, W. J. Collins, 1129 Masonic Temple, Chicago. Meets at noon on the first and third Wednesday of each month at Planters' Hotel.

GAS, ELECTRIC AND STREET RAILWAY ASSOCIATION OF OKLAHOMA. Secretary-treasurer, Prof. H. V. Bozell, Norman, Okla.

GEORGIA ELECTRICAL CONTRACTORS' ASSOCIATION. Secretary, J. M. Clayton, Atlanta, Ga.

HYDROELECTRIC SECTION, N. E. L. A. Secretary, S. A. Sewall, 29 West 39th St., N. Y.

ILLINOIS STATE ELECTRICAL ASSOCIATION. Secretary, H. E. Chubbuck, Peoria, Ill.

ILLUMINATING ENGINEERING SOCIETY. General secretary, J. D. Israel, Engineering Societies Building, 29 West 39th St., New York. Sections in New York, New England, Philadelphia, Chicago and Pittsburgh. Annual meeting, Cleveland, Sept. 21, 1914.

INDEPENDENT ELECTRICAL CONTRACTORS' ASSOCIATION OF GREATER NEW YORK. Secretary, A. Newburger, 1153 Myrtle Ave., Brooklyn, N. Y.

INDEPENDENT TELEPHONE ASSOCIATION OF AMERICA. Secretary, W. S. Vivian, Grand Rapids, Mich.

INDIANA ELECTRIC LIGHT ASSOCIATION. Secretary, Thomas Donahue, Lafayette, Ind.

INDIANA STATE ELECTRICAL CONTRACTORS' ASSOCIATION. Secretary, George Skilman, Indianapolis, Ind.

INSTITUTE OF OPERATING ENGINEERS. Secretary, L. Houmiller, 29 West 39th St., New York.

INSTITUTE OF RADIO ENGINEERS. Secretary, E. J. Simon, 71 Broadway, N. Y.

INTERNAL COMBUSTION ENGINEERS' ASSOCIATION. President, Charles Kratsch, 416 West Indiana St., Chicago. Meeting second Friday of each month at Lewis Institute.

INTERNATIONAL ASSOCIATION OF MUNICIPAL ELECTRICIANS. Secretary, C. R. George, Houston, Tex.

INTERNATIONAL ELECTRICAL CONGRESS. Secretary-treasurer, Preston S. Millar, 80th St. and East End Ave., New York. Congress, San Francisco, Sept. 13-18, 1915.

INTERNATIONAL ENGINEERING CONGRESS. Secretary-treasurer, W. A. Cattell, Foxcroft, Building, San Francisco, Cal. Congress, San Francisco, September, 1915.

INTERNATIONAL ELECTROTECHNICAL COMMISSION (international body representing various national electrical engineering societies contributing to its support). General secretary, C. le Maistre. 28 Victoria St., Westminster, London, S. W., England. Meeting at San Francisco, Sept. 9-11, 1915.

IOWA ELECTRICAL ASSOCIATION. Affiliated with N. E. L. A. Secretary, W. H. Thomson, Des Moines, Ia.

IOWA ELECTRICAL CONTRACTORS' ASSOCIATION. Secretary, M. T. Humphrey, Waterloo, Ia.

IOWA STREET AND INTERURBAN RAILWAY ASSOCIATION. Secretary, H. E. Weeks, Davenport, Ia.

JOVIAN ORDER. Jupiter (president), W. N. Matthews, St. Louis, Mo.; Mercury (secretary), E. C. Bennett, Syndicate Trust Building, St. Louis, Mo.

KANSAS GAS, WATER, ELECTRIC LIGHT AND STREET RAILWAY ASSOCIATION. Secretary-treasurer, Ivor Thomas, 237 South Main St., Wichita, Kan.

LOUISIANA ELECTRICAL CONTRACTORS' ASSOCIATION. Secretary, J. J. Ziegler, 227 Bourbon St. Meeting every Wednesday, Audubon Building, New Orleans.

MAINE ELECTRIC ASSOCIATION. Secretary-treasurer, Walter S. Wyman, Waterville, Maine.

MICHIGAN ELECTRIC ASSOCIATION. Affiliated with N. E. L. A. Secretary, Herbert Silvester, 18 Washington Boulevard, Detroit, Mich. Annual convention, Detroit-Thousand Islands, June 17.

MINNESOTA ELECTRIC ASSOCIATION. Secretary-treasurer, F. A. Otto, St. Paul Gas Light Company, St. Paul, Minn.

MISSISSIPPI ELECTRIC ASSOCIATION. Affiliated with the National Electric Light Association. Secretary - treasurer, H. F. Wheeler, Hattiesburg, Miss. Next annual meeting, Hattiesburg, April 12-14, 1915.

MISSOURI ELECTRIC, GAS, STREET RAILWAY AND WATER WORKS ASSOCIATION. Secretary-treasurer, F. D. Beardslee, Union Electric Light & Power Co., St. Louis.

NATIONAL ARM, PIN AND BRACKET ASSOCIATION. Secretary, J. B. Magers, Madison, Ind.

NATIONAL ASSOCIATION OF ELECTRICAL INSPECTORS. Secretary - treasurer, Wm. L. Smith, Concord, Mass.

NATIONAL DISTRICT HEATING ASSOCIATION. Secretary, D. L. Gaskill, Greenville, Ohio.

NATIONAL ELECTRIC LIGHT ASSOCIATION. Executive secretary, T. C. Martin, Engineering Societies Building, 33 West 39th St., New York.

NATIONAL ELECTRICAL CONTRACTORS' ASSOCIATION OF THE UNITED STATES. Secretary, George H. Duffield, 41 Martin Building, Utica, N. Y.

NATIONAL ELECTRICAL CREDIT ASSOCIATION. Secretary, Frederic P. Vose, 1343 Marquette Building, Chicago. Annual meeting, June, 1914.

NATIONAL FIRE PROTECTION ASSOCIATION. Secretary of electrical committee, Ralph Sweetland, 141 Milk St., Boston, Mass. Open meeting, New York, March, 1915.

NATIONAL INDEPENDENT TELEPHONE ASSOCIATION. Secretary-treasurer, J. B. Earle, Waco, Tex.

NEBRASKA SECTION, N. E. L. A. Secretary-treasurer, S. J. Bell, David City, Neb.

NEW ENGLAND ELECTRICAL CREDIT ASSOCIATION. Secretary, Alton F. Tupper, 60 State St., Boston, Mass. Directors meet first Wednesday of each month.

NEW ENGLAND SECTION, ELECTRIC VEHICLE ASSOCIATION OF AMERICA. Secretary, L. L. Edgar, 39 Boylston St., Boston, Mass.

NEW ENGLAND STREET RAILWAY CLUB. Secretary, H. A. Faulkner, 12 Pearl St., Boston, Mass. Meets last Thursday of each month.

NEW ENGLAND SECTION, N. E. L. A. Secretary, Miss O. E. Bursiel, 149 Tremont St., Boston, Mass. Annual meeting, Narragansett Pier, R. I., Sept. 2-4.

NEW ORLEANS ELECTRICAL CONTRACTORS' ASSOCIATION. Secretary, S. J. Stewart, 312 Carondelet St., New Orleans, La. Meetings, second and fourth Tuesday of each month.

NEW YORK ELECTRIC RAILWAY ASSOCIATION. Secretary, Charles C. Dietz, 239 W. 39th St., New York.

NEW YORK ELECTRICAL CREDIT ASSOCIATION. Affiliated with the National Electrical Credit Association. Secretary, Franz Neilson, 80 Wall St., New York.

NEW YORK ELECTRICAL SOCIETY. Secretary, G. H. Guy, 33 West 39th St., New York. Annual meeting, New York, June, 1914.

NORTHWEST SECTION, N. E. L. A. Secretary, N. W. Brockett, Pioneer Building, Seattle, Wash.

NORTHERN WHITE CEDAR ASSOCIATION. Secretary, R. N. Boucher, 743 Lumber Exchange, Minneapolis, Minn.

OHIO ELECTRIC LIGHT ASSOCIATION. Secretary, D. L. Gaskill, Greenville, Ohio.

OHIO SOCIETY OF MECHANICAL, ELECTRICAL AND STEAM ENGINEERS. Secretary, Prof. F. E. Sanborn, Ohio State University, Columbus, Ohio.

OREGON ELECTRICAL CONTRACTORS' ASSOCIATION. Secretary, F. C. Green, 291 East Morrison St., Portland, Ore. Annual meeting, Portland, June 8-9.

PENNSYLVANIA ELECTRIC ASSOCIATION (State Section N. E. L. A.). Secretary-treasurer, S. C. Pohe, Bloomsburg, Pa.

RAILWAY SIGNAL ASSOCIATION. Secretary-treasurer, C. E. Rosenberg, Times Building, Bethlehem, Pa.

SOCIETY FOR ELECTRICAL DEVELOPMENT, INC. General manager, J. M. Wakeman, 29 West 39th St., New York.

SOCIETY FOR THE PROMOTION OF ENGINEERING EDUCATION. Secretary, Prof. H. H. Norris, Ithaca, N. Y.

SOUTHEASTERN SECTION, N. E. L. A. Secretary-treasurer, A. A. Wilbur, Columbus, Ga. Annual meeting, Isle of Palms, Charleston, S. C., Aug. 19-21, 1914.

SOUTHWESTERN ELECTRICAL AND GAS ASSOCIATION. Secretary, H. S. Cooper, 405 Slaughter Building, Dallas, Tex.

VERMONT ELECTRICAL ASSOCIATION. Secretary-treasurer, A. B. Marsden, Manchester, Vt.

WESTERN ASSOCIATION OF ELECTRICAL INSPECTORS. Secretary, W. S. Boyd, 76 West Monroe St., Chicago, Ill.

WESTERN SOCIETY OF ENGINEERS, ELECTRICAL SECTION. Secretary, J. H. Warder, 1737 Monadnock Block, Chicago.

WISCONSIN ELECTRICAL ASSOCIATION. Secretary, George Allison, 1410 First National Bank Bldg., Milwaukee, Wis.

Weekly Record of Electrical Patents

UNITED STATES PATENTS ISSUED MAY 26, 1914.

[Prepared by Robert Starr Allyn, 16 Exchange Place, New York, N. Y.]

1,097,636. SYSTEM OF ELECTRICAL SIGNALING; E. A. Hummel, St. Paul, Minn. App. filed Oct. 29, 1908. Synchronizing a series of clocks from a master clock.

1,097,640. THERMOSTATIC CIRCUIT CONTROLLER; W. L. Jacoby, Larchmont, N. Y. App. filed Feb. 12, 1913. For fire-alarm systems; protected against dust and moisture.

1,097,644. CALLING DEVICE; W. Kaisling, Chicago, Ill. App. filed April 26, 1911. For two-wire or metallic-line telephone systems.

1,097,651. MEASURING APPARATUS; M. E. Leeds, Philadelphia, Pa. App. filed Nov. 18, 1912. Wheatstone-bridge principle.

1,097,679. ELECTROMAGNETIC SWITCH; W. M. Scott, Philadelphia, Pa. App. filed June 15, 1910. For remote-control systems.

1,097,680. ELECTROMAGNETIC SWITCH; W. M. Scott, Radnor, Pa. App. filed March 8, 1912. Electro-responsive means releases contact member from mechanical control.

1,097,699. ELECTRIC ALARM AND FIRE ESCAPE; F. C. White, Jr., Denver, Col. App. filed July 5, 1912. Rope-ladder system with alarm.

1,097,736. ELECTRICAL-RECEPTACLE-ATTACHING DEVICE; J. S. Stewart, New York, N. Y. App. filed Dec. 18, 1912. For attaching lamp receptacles to sign plate.

1,097,742. DOUBLE-CURRENT GENERATOR; F. H. Wade and W. E. Bauerle, Oak Park, Ill. App. filed April 24, 1912. For converting single-phase generator into double-phase generator.

1,097,760. INTERCOMMUNICATING TELEPHONE SYSTEM; S. A. Koltonski, Boston, Mass. App. filed Nov. 10, 1911. Substitution of the holding coil for the telephone set is effected automatically.

1,097,789. TYPEWRITING MACHINE; T. Cahill, New York, N. Y. App. filed Oct. 17, 1900. Electric typewriter with means to prevent printing one character on top of another.

1,097,801. ELECTROLYTIC CONVERTER FOR THE TRANSFORMATION OF ALTERNATING CURRENTS INTO CONTINUOUS CURRENTS; A. Heinz, Paris, France. App. filed Oct. 22, 1913. Employs circular electrode of lead alloyed with antimony.

1,097,810. DRIVING MEANS FOR ELECTRIC LOCOMOTIVES; G. Lundholm, Vesteras, Sweden. App. filed Jan. 30, 1914. Double-crank system of drive from motor to wheels.

1,097,823. ALTERNATING-CURRENT MOTOR; S. Sparrow, St. Louis, Mo. App. filed May 13, 1911. Commutator type, automatically assuming characteristic resembling that of shunt motor.

1,097,826. ELECTROLYTIC CELL; C. P. Townsend, Washington, D. C., and E. A. Sperry, Cleveland, Ohio. App. filed Dec. 5, 1903. For electrolysis of solutions. (Fifty-five claims.)

1,097,859. MEMBRANEOUS OR DIAPHRAGM TRANSMITTER FOR SUBMARINE SOUND SIGNALS; H. Hecht, Kiel, Germany. App. filed July 7, 1913. Electromagnetically operated tuning fork attached to skin of vessel.

1,097,861. TOLL-OPERATING CIRCUITS; E. E. Hinrichsen, Alexander, Ill., and J. F. Toomey, New York, N. Y. App. filed Nov. 18, 1911. Tandem trunk system.

1,097,867. SELECTOR SWITCH FOR AUTOMATIC TELEPHONE EXCHANGES; F. R. McBerty, New Rochelle, N. Y. App. filed Feb. 26, 1910. Improved mounting for parts of selector switch.

1,097,868. AUTOMATIC TELEPHONE EXCHANGE SELECTOR; F. R. McBerty, New Rochelle, N. Y. App. filed July 23, 1910. For rapidly effecting interconnection of a large number of lines.

1,097,871. ELECTRIC FLASHING DEVICE; T. J. Murphy, Rochester, N. Y. App. filed May 17, 1910. Flashing arc controlled by simple switch.

1,097,872. HIGH-TENSION DEVICE; T. J. Murphy, Rochester, N. Y. App. filed May 17, 1910. Rotatable disk electrodes.

1,097,873. ELECTRIC OSCILLATOR; D. M. Palmer, Los Angeles, Cal. App. filed June 24, 1913. For operating semaphore signal.

1,097,883. ROLLER CONTACT FOR ELECTRIC WELDING MACHINES; K. Schmarje, Frankfort, Germany. App. filed March 13, 1913. Cooling system for large roller contacts.

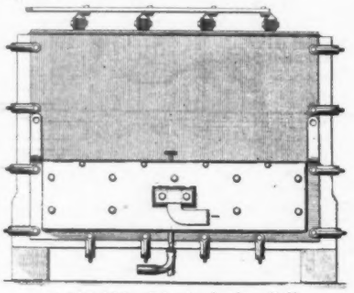
1,097,884. AUTOMATIC-ALARM LOCK; M. Sheinman, New York, N. Y. App. filed May 15, 1913. Alarm circuit closed when lock is tampered with or door forced open.

1,097,895. SPOT-WELDING; E. Thomson, Swampscott, Mass. App. filed May 10, 1913. Welding automatically effected by simply feeding in the sheets to be spot-welded.

1,097,910. ELECTRIC FLASHLIGHT; W. Broad, Beaver Falls, Pa. App. filed June 25, 1913. Has refillable semi-dry cell battery.

1,097,927. AUTOMATIC TELEPHONE-SYSTEM SELECTOR; F. R. McBerty, New Rochelle, N. Y. App. filed Feb. 10, 1910. Terminals supported in rigid relation to the brushes.

1,097,954. MOTOR-DRIVEN VEHICLE; G. R. Wadsworth, Cleveland, Ohio. App. filed Aug. 24, 1912. Electric "compensating motor" is cut into service at certain engine speeds to assist the internal-combustion engine, thus eliminating reduction gearing.



1,097,826—Electrolytic Cell

1,097,960. TELEPHONE REPEATING DEVICE; D. H. Wilson, New York, N. Y. App. filed Jan. 2, 1913. Embodying amplifying device with primary and secondary coil and two induction coils.

1,097,964. FUSE; W. C. Banks, New York, N. Y. App. filed Sept. 5, 1913. Inclosed type with "glass wool" surrounding ends of fuse strips.

1,097,974. RECEIVER FOR WIRELESS COMMUNICATION; W. Harrison, Brooklyn, N. Y. App. filed Aug. 27, 1903. Responsive effect of a number of separate antennas and separate wave detectors is rendered cumulative.

1,098,015. SELECTIVE SWITCH SYSTEM; F. E. Case, Schenectady, N. Y. App. filed Aug. 7, 1908. For cars on roads operating at different potential in different localities.

1,098,016. WATER GAGE; S. E. Caughey, Moline, Ill. App. filed June 18, 1913. With electrical indicators and signal.

1,098,031. MOTION-PICTURE CAMERA; A. C. Forsberg and H. C. Schlicker, New York, N. Y. App. filed Jan. 6, 1914. With steam generator to prevent "static" marking of the film.

1,098,039. SPIRIT LEVEL; A. W. Kibler and J. J. Pennington, Butte, Mont. App. filed Jan. 10, 1914. With built-in lamp for illuminating it in dark corners.

1,098,052. MAGNETO MACHINE; E. Podlesak, Tiffin, Ohio. App. filed July 21, 1911. For ignition purposes.

1,098,085. PISTOL FLASHLIGHT; J. Block, Brooklyn, N. Y. App. filed Sept. 12, 1913. Casing in hinged half sections resembling automatic pistol.

1,098,112. SIGNALING SYSTEM FOR ELECTRIC RAILWAYS; A. D. Hughes and T. H. Hertzog, Washington, Pa. App. filed July 17, 1912. For automatically controlling lights on overhead trolley system.

1,098,120. CABINET; V. F. Larson, Detroit, Mich. App. filed Dec. 4, 1913. Bath cabinet with lamps adjustable therein toward and away from patient.

1,098,133. PANTOGRAPH TROLLEY; S. B. Stewart, Jr., Schenectady, N. Y. App. filed Sept. 10, 1908. Supplemental spring mounting permits contact to have movement independent of trolley structure.

1,098,134. MOTOR CONTROLLERS; F. T. Taylor, New York, N. Y. App. filed July 28, 1909. For removing and then reinserting the regulating resistance.

1,098,192. ELECTRIC RAIL BOND; B. H. Thompson, North Adams, Mass. App. filed March 8, 1913. Spring-pressed bonding devices seated in cavities in abutting rail ends.

1,098,204. CURRENT-DISTRIBUTING NETWORK; G. Wolff, Berlin, Germany. App. filed Oct. 1, 1912. Means for automatically separating the main conductors in sections from one another as soon as fault in insulation occurs.

1,098,211. ELECTRIC SIGN; W. W. Arnold, Hamilton, Ohio. App. filed July 9, 1910. Keyboard-controlled advertising sign.

1,098,226. MAGNETO; W. Casey and I. Lesses, Kingston, Ontario, Canada. App. filed Feb. 15, 1913. High-tension, entirely inclosed waterproof structure.

1,098,231. ELECTRIC ACCUMULATOR PLATE; G. O. Davies, Harrow, Eng. App. filed Feb. 2, 1914. Has reinforcing slats of light material such as wood.

1,098,242. ELECTRIC HORN SWITCH; J. E. Foulks, Jr., New York, N. Y. App. filed Dec. 12, 1912. Contact ring beneath steering wheel, which may be moved without taking hand from wheel.

1,098,246. HOUSING FOR ELECTROMAGNETS; E. Gengenbach, New York, N. Y. App. filed Jan. 11, 1913. Made of sheet metal.

1,098,291. SWIVEL CONNECTOR; G. W. Oakes, Kokomo, Ind. App. filed Oct. 10, 1912. Quickly assembled construction for preventing tangling of conductors about apparatus to which they are attached.

1,098,338. CLEANING METAL SURFACES; C. H. Thompson, Stourbridge, Eng. App. filed May 20, 1913. Bath of chloride, sulphate or nitrate solution through which alternating current is passed.

1,098,345. GENERATION OF POLYPHASE ALTERNATING ELECTRIC CURRENTS OF VARYING FREQUENCIES; W. P. Durtnall, Herne Bay, Eng. App. filed Nov. 1, 1909. For providing speed regulation of motor propelling a vehicle.

1,098,357. PROCESS OF TREATING WOOD FOR STORAGE-BATTERY SEPARATORS; J. M. Skinner, Philadelphia, Pa. App. filed Dec. 26, 1912. Immersing in aqueous solution of sodium sulphide.

1,098,361. FLYWHEEL MAGNETO FOR EXPLOSIVE ENGINES; E. S. Huff, Detroit, Mich. App. filed April 27, 1908. Permanent magnets on flywheel co-operating with coils on engine structure.

1,098,362. BURGLAR ALARM; T. H. Nelson, Chicago, Ill. App. filed July 15, 1912. May be "set" with window adjusted in any position.

13,739 (reissue). PORTABLE RHEOSTAT FOR WELDING APPARATUS; J. M. Yount, San Francisco, Cal. App. filed Oct. 15, 1913. Original patent No. 1,046,708, Dec. 10, 1912. Portable rheostat casing with line taps and covers, which may be raised for ventilation purposes.